TOWN OF DANVILLE

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2020 DRINKING WATER MASTER PLAN

PREPARED BY:

BANNING ENGINEERING
Over 25 Years of Making Your Project Our Priority

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March 13, 2020

2020 DRINKING WATER MASTER PLAN

TOWN COUNCIL ADOPTION

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TOWN OF DANVILLE

2020 DRINKING WATER MASTER PLAN

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CHAPTER 1: PROJECT LOCATION

1.1 SERVICE AREA

The Town of Danville operates a municipal water utility that currently serves potable water to approximately 3,500 water customers in Center Township in Hendricks County, Indiana. The majority of the customers are located within the Town of Danville town limits; however, not all have been annexed into town limits. The service area is restricted from expanding to the east due to the boundary with Citizens Energy Group (CEG). Although, CEG has recently given a portion of this service area to the Town.

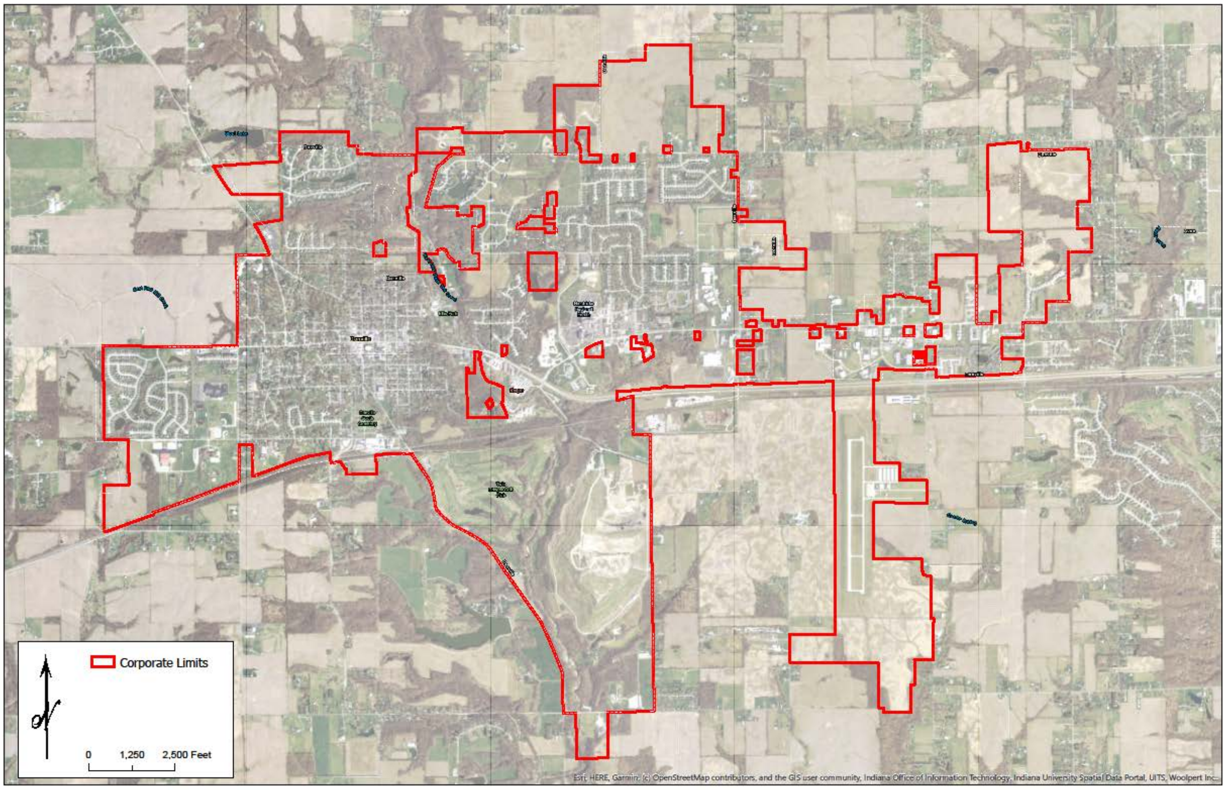

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Figure 1.1.1 – Town Corporate Limits

1.2 PROJECT STUDY AREA

The project study area for the Town includes the current service areas, and potential growth areas in the next 20 years. The potential growth study area looked at the most likely areas of growth within Center Township. More specifically, the areas that growth made the most sense within the bounds of CR 200 West, CR 200 North, CR 200 South, and CR 400 East. The residential growth areas were determined to be North of US-36 and the commercial growth areas were determined to be adjacent to the airport. It was assumed that light commercial and high density residential areas would be along the US 36 and SR 39 corridors. Figure 1.2.1 provides a Future service area map for the Town of Danville.

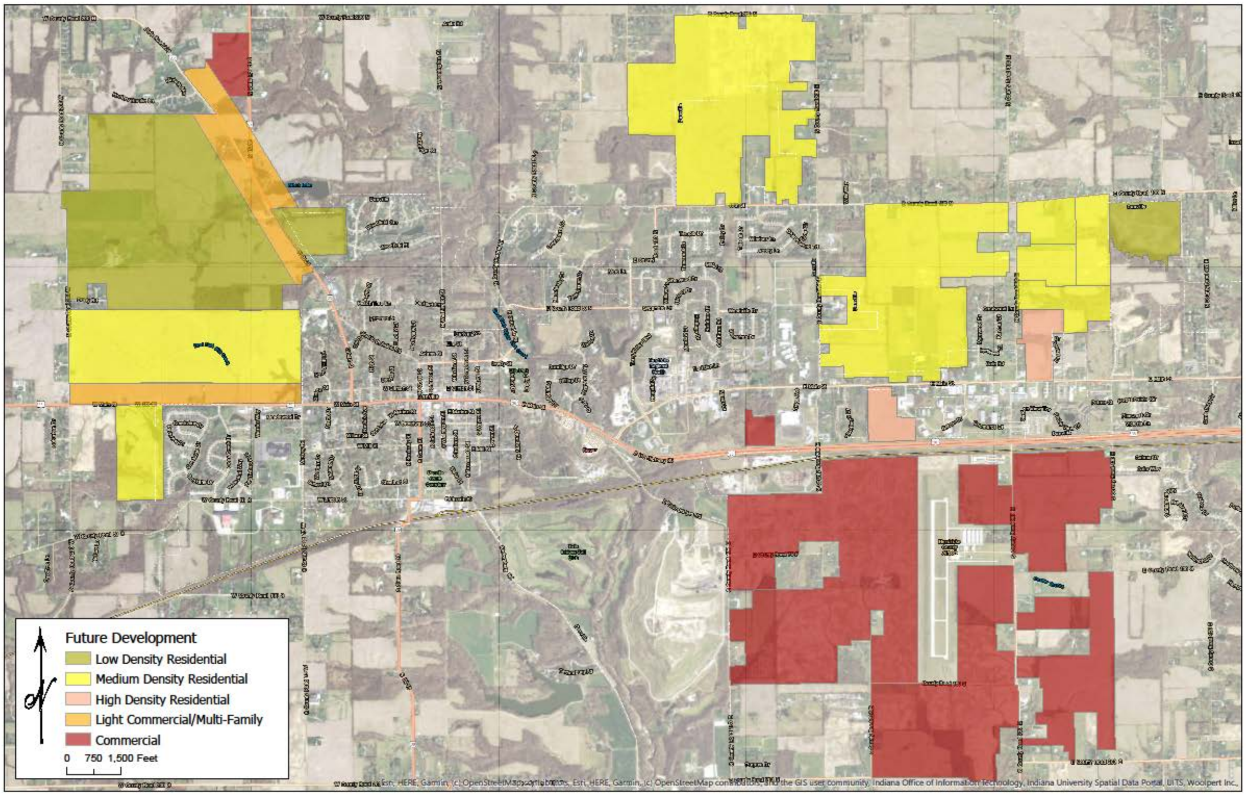

Figure 1.2.1 – Potential Areas of Expansion

CHAPTER 2: CURRENT NEEDS

2.1 DISTRIBUTION SYSTEM

The Town's water distribution system consists of over 60 miles of water mains ranging in size from 3/4" to 14" diameter. The water main materials consist of Galvanized, PVC and Ductile Iron. The original water distribution system was installed in the late 1800's. The utility has continually grown throughout its history and continues to this day. The water distribution system has been extended each year to provide service to new customers or to improve pressure and flow. Figure 2.1.1 shows the map of the distribution system.

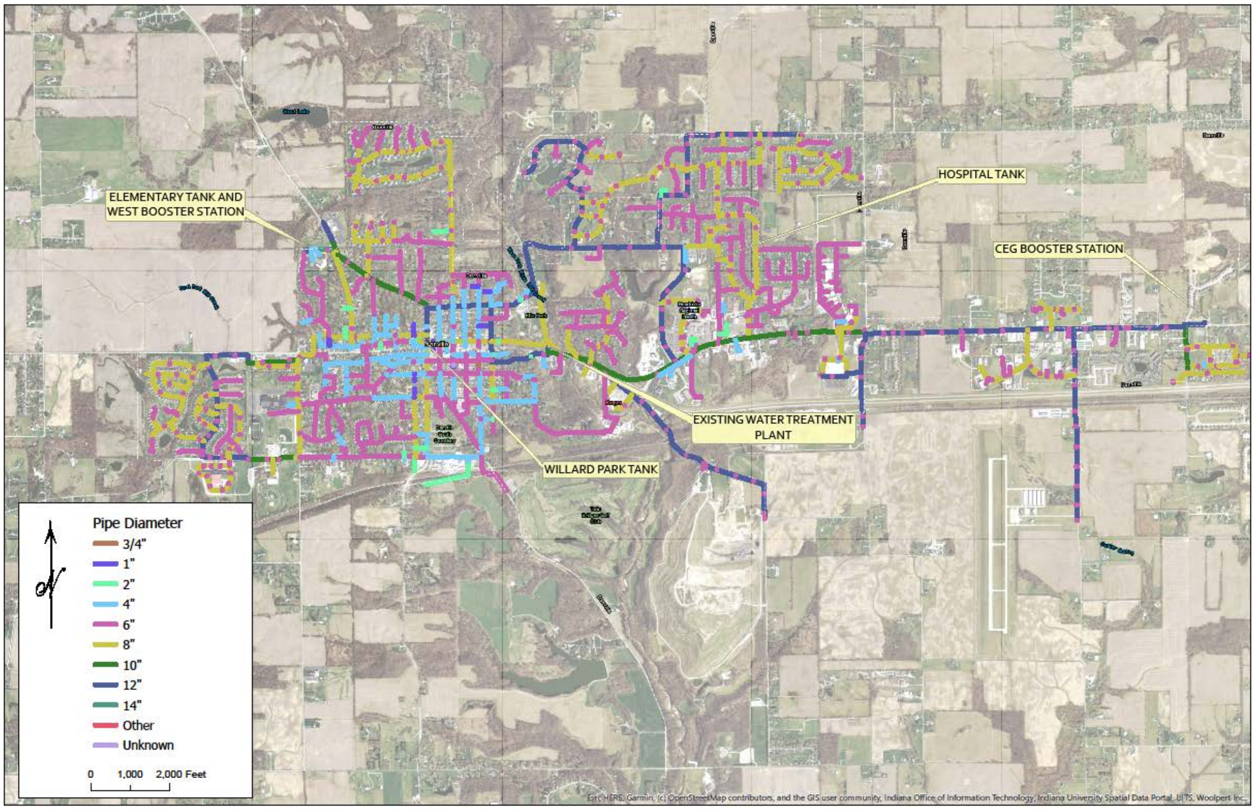

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Figure 2.1.1 – Existing Water Distribution Mains

The treatment plant is located roughly near the center of the distribution system. However, the distribution system is broken up into two pressure zones. There are a few exceptions, but generally the zones are divided so that everything to the east of State Road 39 is on the pressure zone controlled by the plant and water tanks. The remainder of the distribution system is fed via a booster station located to the south of the Elementary Tank.

A pressure monitoring study was performed in conjunction with this master planning study. ADS performed this study and it was used to confirm no pressure issues in the existing system as well as calibrate the hydraulic model used to develop recommendations for the collection system. The data is contained in excel files that will be included separate from this report.

In looking at the hydraulic model when the treatment plant has reached its maximum capacity of 2.0 MGD, it appears that no water mains would require upsizing from a capacity standpoint. However, as growth occurs the main from the new treatment plant to the Elementary Tank would need to be upsized to 20” from the existing 12”.

2.2 SUPPLY

The Town’s source of raw water supply is derived from four (4) water supply wells in a single well field, along with purchasing finished water from Citizens Energy Group as needed during peak flows and emergency situations. The Well Field is located within Ellis Park along the West Fork of White Lick Creek. Additional exploratory drilling for new wells was performed in 2019. One of the two (2) test wells was located in Ellis Park with the other wells. The other test well was located to the west of White Lick Creek and approximately 500 feet to the southwest of the intersection of North 50 East and Sycamore Lane. The second test well was determined to be viable and had a yield of 800 gpm, while no formation was found at the first test well. A well water quality test indicated that the water from the viable well had similar characteristics with the existing supply wells. A copy of this report is included in the Appendix.

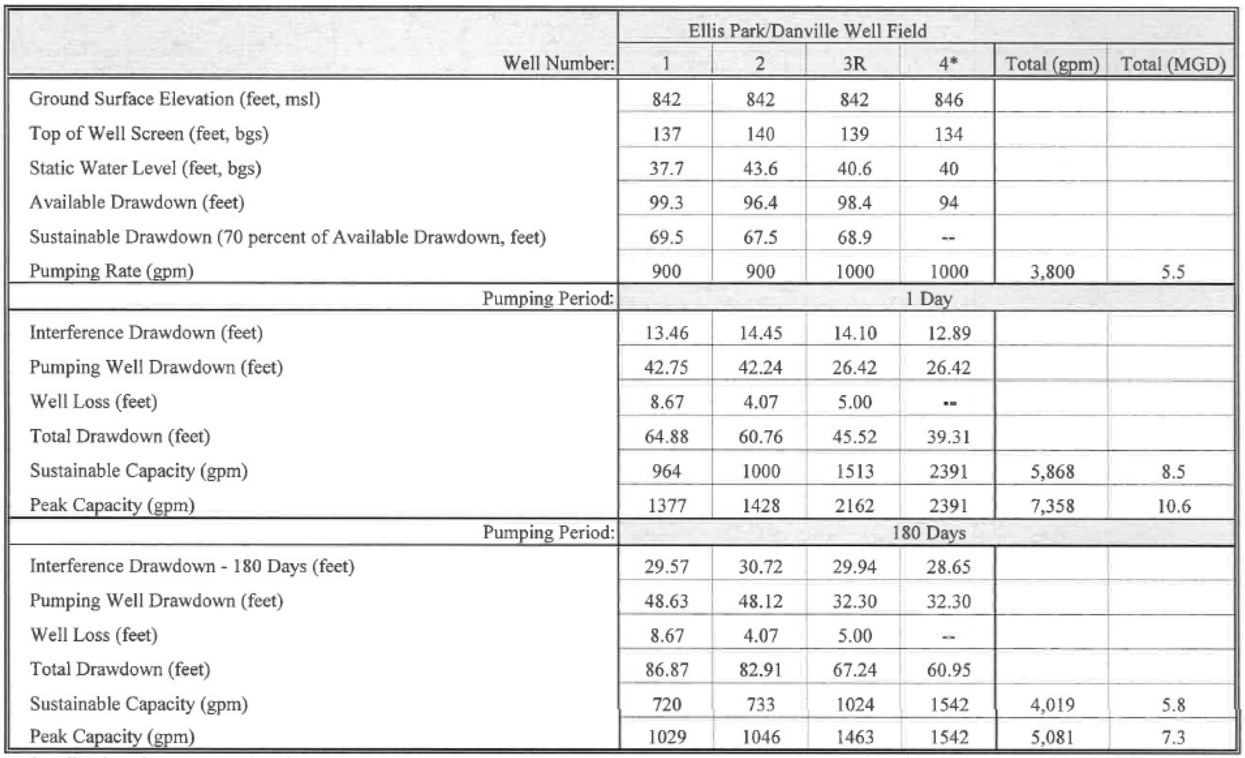
Table 2.2.1 - Town’s Summary of Existing Water Supply Wells

Well No.	*Yield*	*Depth*	*Diameter*
1	*700 gpm*	*157’*	*20”*
2	*700 gpm*	*165’*	*20”*
3R	*1,000 gpm*	*160’*	*20”*
4	*1,500 gpm*	*154’*	*20”*

An hydrogeological study was performed in 2019 in conjunction with the Master Plan. It was concluded that the capacity of the existing wells is approximately 2.5 MGD with a peak capacity of 3.5 MGD. If significant increases in water withdrawal occurs, water-leveling monitoring should be performed as well. It is believed that additional capacity from the well field could be obtained if additional wells were added. Figure 2.2.1 shows the summary table for existing wells from the hydrogeological study. The table can also be found on page 26 of the included Hydrogeological Study.

The Town’s existing wells and well field appear to be adequate to meet current demands. As growth occurs additional wells will need to be added to keep up with higher water volume demands. The actual time this will occur depends on the real growth rate of Town’s customers and any potential wholesale customers that may enter into an agreement with the Town. It is recommended that three (3) additional test wells be drilled in 2020, within the existing aquifer.

When additional wells are constructed or when the new water treatment plant is constructed, it is recommended that the raw water lines between the new well(s) and the existing wells be 12” diameter. Additionally, the raw water lines between well 4 and well 3, and the line between well 3 and well 2 should be upsized to 12” diameter. This would allow for additional flow between the wells when the new plant is constructed due to the headloss in the existing 8” raw water main.



	Ellis Park/Danville Well Field					
Well Number:	1	2	3R	4*	Total (gpm)	Total (MGD)
Ground Surface Elevation (feet, msl)	842	842	842	846		
Top of Well Screen (feet, bgs)	137	140	139	134		
Static Water Level (feet, bgs)	37.7	43.6	40.6	40		
Available Drawdown (feet)	99.3	96.4	98.4	94		
Sustainable Drawdown (70 percent of Available Drawdown, feet)	69.5	67.5	68.9	--		
Pumping Rate (gpm)	900	900	1000	1000	3,800	5.5
Pumping Period:	1 Day					
Interference Drawdown (feet)	13.46	14.45	14.10	12.89		
Pumping Well Drawdown (feet)	42.75	42.24	26.42	26.42		
Well Loss (feet)	8.67	4.07	5.00	--		
Total Drawdown (feet)	64.88	60.76	45.52	39.31		
Sustainable Capacity (gpm)	964	1000	1513	2391	5,868	8.5
Peak Capacity (gpm)	1377	1428	2162	2391	7,358	10.6
Pumping Period:	180 Days					
Interference Drawdown - 180 Days (feet)	29.57	30.72	29.94	28.65		
Pumping Well Drawdown (feet)	48.63	48.12	32.30	32.30		
Well Loss (feet)	8.67	4.07	5.00	--		
Total Drawdown (feet)	86.87	82.91	67.24	60.95		
Sustainable Capacity (gpm)	720	733	1024	1542	4,019	5.8
Peak Capacity (gpm)	1029	1046	1463	1542	5,081	7.3

*Well 4 drawdowns were taken from Well 3R since no pumping test information was available.

Sustainable capacity is the calculated pumping rate using 70 percent of available drawdown. This calculation allows for seasonal variation in water levels and loss of well efficiency over time.

Peak capacity is the calculated pumping rate using all available drawdown.

Figure 2.2.1 – Groundwater Capacity Analysis of Existing Wells

2.3 STORAGE

The Town's has three (3) water storage tanks throughout its water distribution system. Two of the tanks are standpipe ground storage tanks, one of which is welded steel and the other is riveted steel construction. The third tank is a welded steel single pedestal spheroid elevated water storage tank. The table below summarizes the age, location, capacity, year last coated, and overall condition of the five (3) elevated water storage tanks.

Table 2.3.1 - Town's Summary of Existing Water Storage Tanks

Year	*Name*	*Capacity*	*Last Coated*	*Condition*
1892	*Willard Park*	*85,000 gal*	*NA*	*Very Poor*
1961	*Elementary*	*1,000,000 gal*	*2018*	*Good*
2003	*Hospital*	*750,000 gal*	*2019*	*Good*
	Total =	*1,750,000 gal**		

**Willard Park Tank is not in service*

Inspections were performed on the tanks in 2017 by Dixon Engineering. The two main storage tanks have both been topcoated in the last 12 months. The useful life of these coating systems typically ranges from 10 to 15 years. Additionally, the interior coating failures were spot coated to prevent further corrosion. All OSHA and Ten State Standards (TSS) violations were addressed during the rehabilitations.

It is unknown when the Willard Park Tank was last repainted. The tank is in very poor condition and shows high concentrations of lead in the coating. The tank also provides very little in terms of hydraulic value for the distribution system, and has been empty since the July 2017 evaluation. The estimated cost to repaint this tank, which includes lead abatement, as well as make it OSHA and TSS compliant, is over $400,000. A quote for demolition was obtained in 2017 for $12,000. Other than sentimental value as a historical landmark, the tank has little value to the town other than as a potential hazard. It is recommended that the tank be demolished.

The existing two (2) water storage tanks combined capacity of 1.75 million gallons provides adequate storage to meet the Town's current demand of approximately 1.0 million gallons per day. As demand increases it is likely that 2 (two) new elevated storage tanks will be required. One on the west side of Town to both provide additional capacity, and enable the booster station to run periodically rather than constantly. The other tank would be located on the east side of Town, where a large amount of the growth is expected to occur.

It is recommended that a new 500,000 gallon clearwell ground level water storage tank be constructed at the new water treatment plant site. The new clearwell will enable the water treatment plant to be inactive for a period of time for such issues as filter or dentition tank painting, aerator cleaning, and also during filter media replacement. It will also provide additional chlorine contact time before the water is pumped to the distribution system.

2.4 TREATMENT

The Town's Well Field produces raw water of a very safe quality with moderate levels of iron, moderate levels of iron bacteria, low levels of manganese and elevated levels of hardness. This water is satisfactory after aeration, detention, filtration, chlorination and the addition of fluoride. Town's water quality meets the standards of the USEPA Safe Drinking Water Act. Raw water from the four (4) existing water supply wells contains dissolved iron concentrations ranging from 1.6 mg/l to 2.8 mg/l with an average of 2.4 mg/l. Dissolved manganese in these wells ranges from 0.01 mg/l to 0.02 mg/l. The level of iron and iron bacteria presented in these wells, will oxidize and cause a reddish stain on plumbing fixtures and clothing that it contacts. The level of manganese present will oxidize and will rarely cause any grayish black staining on clothing and plumbing fixtures that it contacts. The USEPA Secondary Drinking Water Standards limits the level of iron in drinking water to 0.30 mg/l and the level of manganese to 0.05 mg/l. Therefore, the level of iron in the raw well water, exceeds the USEPA standards for finished drinking water, thus requiring treatment for iron and manganese removal. The concentration of Calcium Carbonate Hardness in these wells range from 200 mg/l to 250 mg/l. A water hardness level greater than 180 mg/l is considered VERY HARD water. The concentrations present in Town's wells are considered VERY HARD water. A raw water analysis for the most recently constructed test well (TW 19-1) are included in the appendix of this Report.

Water treatment is essential for the source water available to Town's to reduce the concentrations of iron and manganese to levels conforming to the Secondary Drinking Water Standards. The Town currently has one water treatment plant (Plant No. 1) which is summarized in Table 2-4 below. The water treatment plant consistently produces finished drinking water with iron concentrations and manganese concentrations below the USEPA Secondary Drinking Water Standards. The satisfactory finished water quality at Town's demonstrates that the existing water treatment process of aeration, detention and filtration effectively achieves good quality water and should be continued to be utilized.

Table 2.4.1 - Town's Summary of Existing Water Treatment Plant

Year	*Name*	*Capacity*	*Condition*
2004	*Plant No. 1*	*1,400 gpm*	*Good*

Plant No. 1 was placed into service in 2005 and was rated for 1,400 gpm or 2.0 MGD. However, due to the presence of iron bacteria, the filters cannot run at the designed rating, and require frequent backwashing and regular periodic replacement of filter media. There is no filter backup during times that a filter is down for maintenance or repairs, therefore, diminishing plant production by 50%. Normal useful life of treatment plant equipment is 20 years and structures are 50 years. Plant No. 1 consists of a single aerator located outside the water treatment plant, and a single aeration detention tank and two 700 gpm open top filters located inside the water treatment plant. The aerator that receives raw water from the water supply wells. Water enters the top of the aerator and falls by gravity though the aerator. As raw water falls through the aerator trays, an induced draft aerator lifts air up through the falling water. The aeration step exposes the dissolved iron and manganese to oxygen that commences an oxidation process that causes the iron and manganese to precipitate out of solution into a state that allows removal by settlement in the detention tank, followed by filtration.

Water exiting the aerator falls down into the detention tank, which serves as a reaction basin that provides 30 minutes of detention time for the aerated water. This 30 minute detention time facilitates the oxidation process between the iron and oxygen and the manganese and oxygen. At the end of 30 minutes, the iron oxide and manganese oxide are in the form of a solid and are ready for removal by filtration via the open top filters located inside the building. The finished water gravity flows through the filters and into a nominal 80,000 gallon finished water concrete clearwell located directly below the finished floor of the water treatment plant. The high service pumps, 2- 350 gpm & 2- 700 gpm, respectively, take suction from the clearwell prior to pumping water into the water distribution system. The high service pumps have soft starters to minimize water hammer in the distribution, but can only be ran at 100% speed.

With Plant No. 1 nearing its useful life on equipment and key process components, the capacity has diminished from the plant original rating of 1,400 gpm. With the recommendation of a new water treatment plant, Plant No. 1 can be ran at a much lower rate and extend the useful life, as well as giving the benefit of a back-up and flexibility during peak flow demands.

Plant No. 1 add chlorine and phosphates to the water. These chemical feed and storage systems are housed in the water treatment plant building. Chlorine is added for disinfection. Chlorination is achieved by using 150-pound chlorine cylinders and vacuum ejectors to withdraw chlorine gas and mix it with water to inject a solution of dissolved chlorine into the raw water from the well field ahead of aeration for pre-chlorination and after the filters prior to the high service pumps for post-chlorination. The post-chlorination points are inside the building of Plant No. 1. The chlorine cylinders are stored in Plant No. 1 in a separate room with proper ventilation. Chlorine cylinders are placed on chlorine scales for continuous measurement of the weight of remaining liquid chlorine. The addition of phosphates is to the treated water by means of a chemical metering pump. Phosphates are used for corrosion control in the distribution system. Fluoride is naturally occurring in the groundwater at an average concentration of 1.8 mg/l.

2.5 POPULATION

Population data was obtained for Indiana, Hendricks County, The Town of Danville, and Center Township from the U.S. Census Bureau. Table 2.5.1 provides a tabulation of the U.S. Census historical population data for Hendricks County, the Hendricks County Townships, and The Town of Danville from the year 1920 through 2010. This table shows that the Town has experienced continual growth during this 90 year period. Table 2.5.2 provides a tabulation of the U.S. Census estimated population data for Town from the year 2010 through 2019. This table shows that Town is estimated to continue to grow during this estimated period. Table 2.5.3 provides a tabulation of population projections from the year 2020 through 2040 based upon the average annual population growth experienced from the historical data and the population estimates shown in the U.S. Census data reflected in Tables 2.5.1 and 2.6.2.

Table 2.5.1 – Indiana Population Data by Decade (1920-2010) U.S. Census Bureau Data (in 1,000's)

1920	*1930*	*1940*	*1950*	*1960*	*1970*	*1980*	*1990*	*2000*	*2010*
2,930	*3,238*	*3,427*	*3,934*	*4,662*	*5,195*	*5,490*	*5,544*	*6,080*	*6,483*

Table 2.5.2 – Hendricks County Population Data by Township & Decade (1920-2010) U.S. Census Bureau Data

Townships	*1920*	*1930*	*1940*	*1950*	*1960*	*1970*	*1980*	*1990*	*2000*	*2010*
Brown	*844*	*801*	*770*	*769*	*1,106*	*2,113*	*4,176*	*4,617*	*8,142*	*11,593*
Center	***3,075***	***3,131***	***3,373***	***4,249***	***5,154***	***5,819***	***7,057***	***7,359***	***9,744***	***12,167***
Clay	*1,733*	*1,485*	*1,446*	*1,609*	*1,871*	*1,889*	*2,030*	*1,992*	*2,211*	*2,256*
Eel River	*1,739*	*1,443*	*1,443*	*1,504*	*1,588*	*1,628*	*1,595*	*1,541*	*1,713*	*1,662*
Franklin	*991*	*939*	*836*	*932*	*1,106*	*1,157*	*1,261*	*1,135*	*1,198*	*1,297*
Guilford	*3,162*	*3,339*	*3,603*	*4,855*	*11,001*	*14,439*	*17,052*	*19,468*	*22,895*	*27,844*
Liberty	*2,099*	*2,193*	*2,140*	*2,472*	*3,353*	*4,017*	*4,719*	*4,566*	*5,072*	*5,772*
Lincoln	*1,798*	*1,801*	*1,925*	*2,600*	*6,660*	*10,489*	*13,351*	*14,008*	*18,967*	*28,665*
Marion	*988*	*854*	*837*	*781*	*979*	*1,053*	*1,289*	*1,273*	*1,398*	*1,402*
Middle	*1,630*	*1,396*	*1,420*	*1,621*	*2,004*	*2,345*	*3,189*	*3,466*	*4,657*	*6,170*
Union	*930*	*889*	*829*	*899*	*1,072*	*1,252*	*1,579*	*1,586*	*1,777*	*1,856*
Washington	*1,302*	*1,454*	*1,529*	*2,303*	*5,002*	*7,773*	*12,506*	*14,706*	*26,319*	*44,764*
Hendricks County	**20,291**	**19,725**	**20,151**	**24,594**	**40,896**	**53,974**	**69,804**	**75,717**	**104,093**	**145,448**

Average annual population growth from 1920-2010 = 2.21%

Table 2.5.3 – Town of Danville Population Data by Decade (1920-2010) U.S. Census Bureau Data

1920	*1930*	*1940*	*1950*	*1960*	*1970*	*1980*	*1990*	*2000*	*2010*
1,729	*1,930*	*2,093*	*2,802*	*3,287*	*3,771*	*4,220*	*4,345*	*6,418*	*9,001*

Average annual population growth from 1920-2010 = 1.85%
2010 Danville Household Population = 2.72 persons/household
2010 Indiana Household Population = 2.32 persons/household
2010 Hendricks County Population Density = 357.4 people/square mile
2010 Indiana Population Density = 181 people/square mile

Table 2.5.4 – Town of Danville Population Estimate (2010-2019) U.S. Census Bureau Data

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
9,079	9,152	9,162	9,418	9,583	9,595	9,670	9,833	9,922	10,707

Average annual estimated population growth from 2010-2019 = 1.85%

Table 2.5.5 – Town of Danville Population Projection for Waterworks Planning (2020-2040)

	2020	2025	2030	2035	2040
Danville	10,906	11,952	13,100	14,357	15,735

Average annual estimated population projection is based upon an assumed 1.85%

There were several options for estimating the population through 2040. Hendricks county as a whole, had a higher growth rate due to the large growth within the townships closer to Avon, Brownsburg, and Plainfield. Since the Town generally only services people within the Town, we decided to use the Towns historical growth rate of 1.85%.

2.6 CURRENT WATER CONSUMPTION

Table 2.6.1 provides a summary of pumpage from 2000 through 2019. The summary includes the average daily pumpage as well as the peak day during that year. Table 2.6.2 shows the projected pumpage through 2040 based on the average daily increase in pumpage of 2.32% per year.

Table 2.6.1 – Summary of Historical Daily Pumpage 2000-2019 (MG)

Year	Average Day	Peak Day	Peaking Factor
2000	0.650	Not Available	
2001	0.684	Not Available	
2002	0.721	1.141	1.583
2003	0.795	1.232	1.550
2004	0.895	1.392	1.555
2005	0.925	1.537	1.662
2006	0.894	1.822	2.038
2007	0.923	1.736	1.881
2008	0.910	1.511	1.660
2009	0.880	1.342	1.525
2010	0.903	1.472	1.630
2011	0.778	1.218	1.566
2012	0.955	1.535	1.607
2013	0.889	1.404	1.579
2014	0.849	1.622	1.910
2015	0.852	1.244	1.460
2016	0.889	1.320	1.485
2017	0.895	1.221	1.364
2018	0.937	1.290	1.377
2019	1.005		

Average annual pumpage increase from 2000-2019 = 2.32%

Table 2.6.2 – Summary of Projected Daily Pumpage 2020-2040 (MG)

Year	*Average Day*	*Peaking Day Factor*	*Peak Day Pumpage*	*Peak Hour Factor*	*Peak Hour Pumpage*
2020	*1.028*	*1.8*	*1.850*	*1.5*	*2.775*
2025	*1.153*	*1.8*	*2.075*	*1.5*	*3.113*
2030	*1.293*	*1.8*	*2.327*	*1.5*	*3.491*
2035	*1.451*	*1.8*	*2.612*	*1.5*	*3.918*
2040	*1.627*	*1.8*	*2.929*	*1.5*	*4.393*

Table 2.6.2 shows the projected daily pumpage through 2040. The average daily pumpage is calculated at the average annual increase in the average daily pumpage between 2009 and 2019 of 2.32%. A peaking factor of 1.8 is used to determine the peak daily pumpage. A peaking factor of 1.5 is then used to determine a peak hour pumpage. Based on these values, if pumpage increases at its current rates, the system demand would surpass the plant capacity around 2024.

Table 2.6.3 – Summary of Town's Design Flows & Plant Capacities (6/2018-6/2019)

Plant Capacity (gpd)	*2,016,000 (rated)*
Plant Capacity (gph)	*84,000 (rated)*
Average Daily Pumpage(gpd)	*1,005,000*
Peak Daily Pumpage (gpd)	*1,290,000*
1-hr Peak Pumpage (1.5x)	*1,935,000*
Plant Capacity Used on Average Day	*49.85 %*
Percent Plant Capacity Used on Peak Day	*63.99 %*
Percent Plant Capacity Used on 1-hr. Peak Pumpage (1.5x)	*95.98 %*

1. *Typical Values for demand factors taken from Velon and Johnson (1993). Reprinted by permission of The McGraw Hill Companies.*

Table 2.6.3 shows that the rated plant capacity is 2,016,000 MGD. The average daily pumpage and peak daily pumpage can be found in Table 2.6.1. The average daily pumpage of 1,005,000 is using nearly 50% of its rated capacity. The peak demand day in 2019 used approximately 66% of its rated capacity. A peaking factor of 1.5 was used in calculating the peak total daily pumpage of 1,935,000. This 1-hr peak flow uses nearly 96% of its rated capacity. Fortunately, Town has a connection with Citizens Energy Group as a supplemental back up, and the Town has 1.75 million gallons of tank storage in the distribution system to meet the current demands of Town's existing customers.

Significant development is anticipated to occur over the next five (5) years. Currently the Town has approved 509 EDU's of development on the east side of Town and are under construction. Figure 2.6.4 shows these areas of development. Figure 2.6.5 shows a summary of the existing flows with the proposed developments added. IDEM restricts additional development once the average of 5 peak days over the last 2 Years exceeds 90% of the treatment plant's capacity, 1.8 MGD.

CURRENT USAGE AND PLANT CAPACITY SUMMARY

	MGD	GPM	EDU'S	PERSONS
EXISTING WTP CAPAICTY	2.016	1400		
IDEM LIMIT (90% OF WTP CAPACITY)	1.814	1260		
AVG. 5 HIGHEST PUMPAGES PREVIOUS 2 YEARS	1.266	879		
AVAILABLE CAPACITY	0.548	381		
1 RESIDENTIAL CUSTOMER (IDEM)		0.87	1	
AVAILABLE RESIDENTIAL CUSTOMERS (IDEM)	**0.548**	**381**	**438**	**1191**
CURRENTLY APPROVED/UNDER CONSTRUCTION	**0.638**	**443**	**509**	**1384**
WOODLAND TERRACE	*0.138*	*96*	*110*	*299*
CAMDEN CREEK	*0.158*	*110*	*126*	*343*
KENSINGTON PHASE 1	*0.170*	*118*	*136*	*370*
KENSINGTON PHASE 2	*0.172*	*119*	*137*	*373*

Figure 2.6.4 – Flow Summary with Current Developments

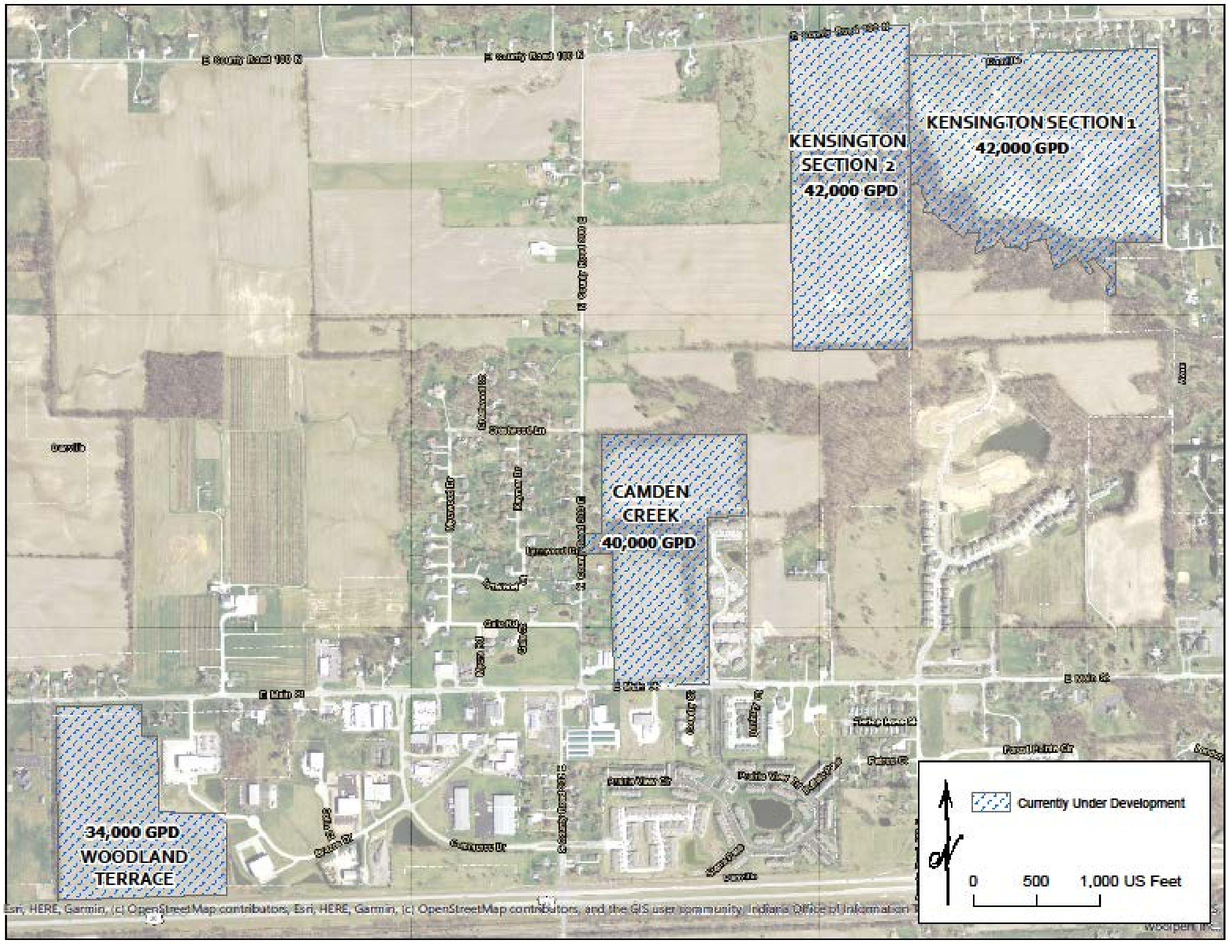


Figure 2.6.5 – Current Developments

Thus, it is projected that the 1.8 MGD threshold will be overcome with the current new developments under construction. It is recommended that a new Water Treatment Plant be constructed immediately, or a new full time supply agreement with CEG occur immediately to allow for additional development to take place.

CHAPTER 3: FUTURE NEEDS

3.1 PROJECTIONS

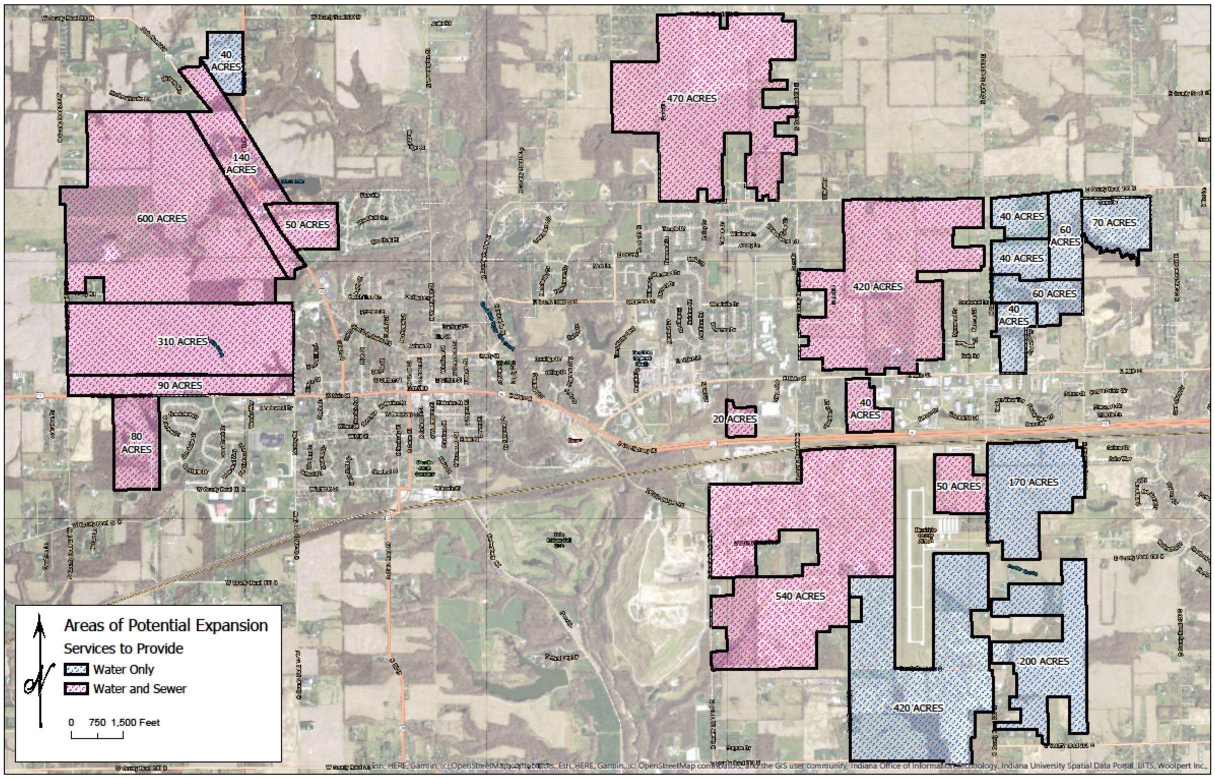
This study required the approach of looking at growth through 20 years and what the future needs would be to service the potential service area around the Town. Growth is currently occurring on the east side of Town and will likely continue. However, if the wastewater capacity issues are addressed on the west side of Town, it is likely growth will occur there and on the east side of Town.

3.1.1 20-YEAR POPULATION PROJECTION

The Town of Danville serves water to customers in Center Township in Hendricks County; however, the majority of the customers are located within the Town of Danville. Table 2.5.2 provides a tabulation of the U.S. Census historical population data for Hendricks County as well as Center Township. Table 2.5.3 provides a tabulation of the U.S. Census historical population data for the Town of Danville. The growth rate of Center Township is lower than some of the neighboring townships, such as Washington, Guilford, and Liberty. These higher growth areas are limited in remaining areas of growth and it is expected that Center Township would begin to experience higher growth rates in the next 20 years. These areas of growth are most likely to the east and west of the Town. For purposes of waterworks planning we assumed that the Town's service area would experience the same rate of growth over the next 20 years as Danville's 1.85% annual growth rate that was determined from Table 2.5.3 and that the populations of the Town and customers served would remain nearly the same. Using the 1.85% average annual estimated population growth projection, it is estimated that the Town's population will grow from 10,906 in 2020 to 15,735 in 2040 as shown in Table 2.5.5. This would mean that the estimated number of water customers for the Town would be 15,737 in 2040. This is an overall increase in population of nearly 45% over the 20 year period. This projected growth does not take into consideration any future demands on the system by: (i) potential sales for resale customers, or (ii) taking over the service territory of other systems, such as Citizens Energy Group.

3.1.2 SERVICE AREA POPULATION PROJECTION

Outside of the 20 year population projection, the potential service area was looked at to determine capacity needed beyond 2040. Figure 3.1.1 shows the potential service area and Figure 3.1.2 is a break down of these ultimate flows. The average daily flow for the projected service area is approximately 4.2 MGD, with a peak of 7.5 MGD.



Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.

Figure 3.1.1 – Potential Areas of Expansion

Estimated Flows from Future Developments

Location	Size	Devlopment Type	Homes (If Residential)	Flow Units	Average Daily Flow Contributions
WEST OF CLEAR CREEK, SOUTH OF MAIN STREET	80 ACRES	MEDIUM DENSITY RESIDENTIAL	200	310 GPD/HOME	60,000 GPD
WEST OF TOWN, NORTH OF MAIN STREET	90 ACRES	LIGHT COMMERCIAL/ MULTI-FAMILY	N/A	2,000 GAL/ACRE/DAY	180,000 GPD
WEST OF TOWN, NORTH OF ABOVE PROPERTY	310 ACRES	MEDIUM DENSITY RESIDENTIAL	775	310 GPD/HOME	240,000 GPD
NORTHWEST OF TOWN, EAST OF 200 WEST AND WEST OF SR39	600 ACRES	LOW DENSITY RESIDENTIAL	1,200	310 GPD/HOME	370,000 GPD
NORTH OF ELEMENTARY SCHOOL ALONG SR39	140 ACRES	LIGHT COMMERCIAL /MULTI-FAMILY	N/A	2,000 GAL/ACRE/DAY	280,000 GPD
NORTH OF SR236 AND WEST OF CR 100 WEST	40 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	30,000 GPD
FINAL PHASE OF WOODFIELD	50 ACRES	LOW DENSITY RESIDENTIAL	100	310 GPD/HOME	30,000 GPD
NORTH OF OLD FARM, TO THE NORTH OF 10TH STREET	470 ACRES	MEDIUM DENSITY RESIDENTIAL	1,175	310 GPD/HOME	360,000 GPD
WEST OF WALMART, NORTH OF US36	20 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	10,000 GPD
WOODLAND TERRACE	40 ACRES	HIGH DENSITY RESIDENTIAL	110	310 GPD/HOME	34,000 GPD
BEASLEY'S AND FARM FIELDS BETWEEN MAIN STREET, 200 EAST, 10TH STREET, AND 300 EAST	420 ACRES	MEDIUM DENSITY RESIDENTIAL	1,050	310 GPD/HOME	330,000 GPD
GALECREST SUBDIVISION	N/A	EXISTING SUBDIVISION	64	310 GPD/HOME	20,000 GPD
CAMDEN CREEK	40 ACRES	HIGH DENSITY RESIDENTIAL	126	310 GPD/HOME	40,000 GPD
DIRECTLY NORTH OF CAMDEN CREEK	60 ACRES	MEDIUM DENSITY RESIDENTIAL	120	310 GPD/HOME	50,000 GPD
SOUTH OF 10TH STREET, EAST OF 300 EAST	40 ACRES	MEDIUM DENSITY RESIDENTIAL	80	310 GPD/HOME	30,000 GPD
SOUTH OF 10TH STREET, EAST OF 300 EAST	40 ACRES	MEDIUM DENSITY RESIDENTIAL	80	310 GPD/HOME	30,000 GPD
KENSINGTON SECTION 2	60 ACRES	MEDIUM DENSITY RESIDENTIAL	137	310 GPD/HOME	42,000 GPD
kENSINGTON SECTION 1	70 ACRES	LOW DENSITY RESIDENTIAL	136	310 GPD/HOME	42,000 GPD
WEST OF AIRPORT	620 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	430,000 GPD
SOUTH AND SOUTHEAST OF AIRPORT, WEST OF 300 EAST	340 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	240,000 GPD
NORTHEAST OF AIRPORT, WEST OF 300 EAST	50 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	40,000 GPD
NORTHEAST OF AIRPORT, EAST OF 300 EAST	170 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	120,000 GPD
SOUTHEAST OF AIRPORT, EAST OF 300 EAST	200 ACRES	COMMERCIAL	N/A	700 GAL/ACRE/DAY	140,000 GPD

TOTAL ADDITIONAL AVERAGE DAILY FLOW	**3,148,000 GPD**
CURRENT AVERAGE DAILY FLOW	**1,050,000 GPD**
PROJECTED AVERAGE DAILY FLOW	**4,198,000 GPD**
PROJECTED PEAK DAILY FLOW	**7,500,000 GPD**

Figure 3.1.2 – Future Expansion Estimated Flows

3.2 DESIGN FLOWS

Given that the vast majority of the Town's existing customers are residential in nature, the recommended 20-Year design flows are based on population growth projections, customer growth projections, historical water usage, and historical customer information. Table 3.2.1 provides a summary of estimated design flows based on the estimated annual population growth of 1.85% over the next 20 years, as shown in Table 2.5.5. Table 3.2.2 provides a summary of estimated design flows based on the estimated annual pumpage increase of 2.32% based upon Table 2.6.1. Both methods of projecting design flows are, in our opinion, reasonable. Therefore, the projected 20-Year projected daily design flow is 1,800,000 gpd with peak flows up to 4,320,000 gpd. As shown above in Figure 3.1.2, the projected average daily flow for the future service territory would be 4,200,000 gpd. For future planning the water treatment plant should be expandable to handle this future design flow.

<u>Table 3.2.1 – Summary of Town's Water Pumpage based upon 20-Year Population Projection (2040)</u>

Estimated Population Served by Town (1.85% AAG)....15,735 people
Average Daily Pumpage per Person…………………………...114 gpd
Average Daily Pumpage for Town …………………….1,793,790 gpd
Peak Daily Pumpage for Town (1.8 P.F.)……………..3,228,822 gpd
1-hr. Peak Pumpage for Town (1.5 Peak Daily)……….201,801 gph

1. *Typical Values for demand factors taken from Velon and Johnson (1993). Reprinted by permission of The McGraw Hill Companies.*

<u>Table 3.2.2 – Summary of Town's Water Pumpage based upon 20-Year Pumpage Projection (2040)</u>

Estimated Average Daily Pumpage (2.32% AAG)……..1,627,000 gpd
Peak Daily Pumpage for Town (1.8 P.F.)...……………….2,928,600 gpd
1-hr. Peak Pumpage for Town (1.5 Peak Daily)……….183,038 gph

1. *Typical Values for demand factors taken from Velon and Johnson (1993). Reprinted by permission of The McGraw Hill Companies.*

New Water Treatment Plant Initial Design Capacity………………….3,000,000 gpd
New Water Treatment Plant Full Build Out Design Capacity……….6,000,000 gpd

1. *Typical Values for demand factors taken from Velon and Johnson (1993). Reprinted by permission of The McGraw Hill Companies.*

3.3 20-YEAR AND FUTURE NEEDS

<u>Distribution System</u>

The existing line at the proposed location of the new treatment plant is 12" diameter ductile iron. It is recommended that the portion of this line from the new plant up to the Elementary Tank be upsized to 20" diameter ductile iron. The hydraulic model indicated that this was the minimum size needed to be able to meet future demands of the high pressure side of the system.
It is recommended that several new water main extensions and loop connections should be installed. The order of these extensions and loop connections will be determined by which areas of Town and Center Township develop first.

The water main extensions on the west side of town would be 12" diameter ductile iron pipe. The total length of the west water main extensions would be approximately 34,500 feet. These extensions would essentially loop in the area between 200 West, Main Street, and State Road 39. These new water main extensions would have properly spaced new fire hydrants and new line valves

There is currently a dead end at the corner of County Road 150 East and County Road 75 South. This should be extended along County Road 150 East, County Road 200 South, County Road 225 East, County Road 150 South, and County Road 300 East where it would tie into the dead end located to the east of the airport. An additional extension from the dead end on County Road 200 East to the south of US 36 should be extended along County Road 200 East and County Road 75 South. This totals approximately 25,500 feet of 12" diameter water main extensions. The new water main extensions would have properly spaced new fire hydrants and new line valves

To the northeast of Town, the looping connection along 10th Street and County Road 200 East that would connect the 2 existing dead ends could be made at any time. An additional main should be ran from the intersection of 10th Street and 200 East to the new water main providing service to the Kensington Subdivisions. Another main extension should be installed along County Road 200 East from the Kensington Main Extension, to County Road 100 North. These main extensions would be approximately 14,000 feet and would have properly spaced new fire hydrants and new line valves.

These new water main extensions can be seen in Figure 3.3.1.

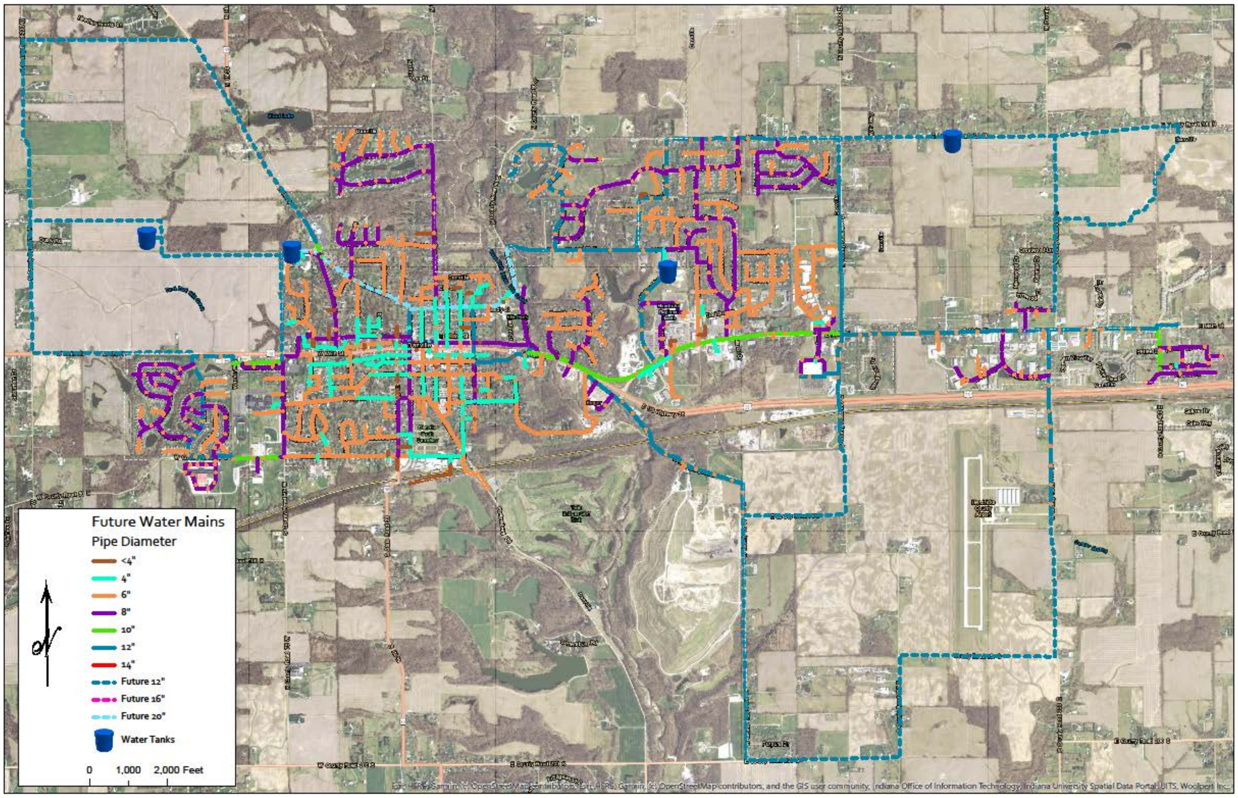


Figure 3.3.1 – Future Distribution System

As the demand increases on the west side of town, the booster station will need to be upgraded to keep up with demand. Currently, the booster pumps run continuously to keep the pressure near a defined set point. We recommend (as discussed below in the storage section) that a tank be installed that would allow for the booster pumps to cycle rather than run continuously. It is believed that the eventual booster pumps would be approximately capable of pumping 2,100 GPM.

Supply

As previously described in section 2.2, it is recommended that the Town of Danville add additional wells. Once additional wells are added it is recommended that the raw water main between wells 2 and 3 and between wells 3 and 4 be upsized to a minimum of 12" diameter. During peak demands it is likely that the velocity in the existing 8" diameter mains would exceed the recommended maximum velocity of 8ft/s.

Storage

The average 20-year design flow of approximately 3.0 MGD exceeds the existing combined tank capacities of 1.75 MG by 1.25 MG. The proposed new water treatment plant is designed to be easily expandable should the 20-year design flow be exceed in the future. The initial design would be for a 3 MGD plant which could be expanded up to 6.0 MGD plant in the future. To meet the increase storage capacity for an average daily demand, an additional two (2) elevated water storage tanks would ultimately need to be installed within the system. We would recommend the installation of a 1 MG elevated spheroid water tank within the boosted area. This area would also help to reduce the run times of the western booster station. The second tank would be a 0.75 MG spheroid elevated water tank located on the east side of town near CR 200 East and CR 100 North.

As previously described in section 2.3, it is recommended that a new 500,000 gallon clearwell ground level water storage tank be constructed at the new water treatment plant site. The new clearwell will enable the water treatment plant to be inactive for a period of time for such issues as filter or dentition tank painting, aerator cleaning, and also during filter media replacement. It will also provide additional chlorine contact time before the water is pumped to the distribution system.

Treatment

As previously described in section 2.4, it is recommended that Plant No. 1 remain in service as a back-up and a new water treatment plant to be constructed to meet the Town's needs for the next 20 years and extending the useful life of the existing Plant No. 1. It is recommended that a new 3.0 MGD water treatment plant be constructed with provisions made in the design for expansion, should other potential users not included in the 20-year design arise that would accelerate demand, provisions can be made to accommodate additional equipment and filters in order to expand capacity.

CHAPTER 4: EVALUATION OF ALTERNATIVES

The proposed waterworks improvements project for the Town of Danville includes construction of a: 3.0 MGD water treatment plant, two (2) new supply wells, and a 0.5 MG gallon ground level clearwell. The purpose of this section is to examine the proposed project and evaluate it in comparison to feasible alternatives.

4.1 EVALUATION OF ALTERNATIVES

Alternatives for addressing concerns with the EBWC's water treatment, storage, and maintenance needs include the following:

1. Construction of one new 3.0 MGD water treatment plant, two (2) supply wells and 0.5 MG ground level clearwell
2. New Agreement for Interconnect with Citizens
3. No Action: Continue current operations.

4.1.1 Alternative 1: Construction of one new 3.0 MGD water treatment plant, two (2) supply wells and 0.5 MG ground level clearwell

Construction of the new 3.0 MGD water treatment plant, two (2) supply wells and 0.5 MG ground level clearwell would provide the following benefits:

1. Extend the life of the existing 15-year old iron and manganese removal plant by being able to run it at a lower pumping rate
2. Provide adequate finished water supply to meet current peak demands and the anticipated 20-year average and peak design demands.
3. Provide operational flexibility at the water treatment plant for maintenance and reliability.
4. Provide redundant safety and reliability should a power failure occur at the water supply wells.
5. Provide additional raw water supply and capacity to the treatment plant(s).
6. Provide adequate finished water storage and flexibility of operation.

4.1.2 Alternative 2: Negotiate a new agreement with Citizens Energy to gain additional water through the interconnect

The current agreement between the Town and Citizens is that the interconnect will only be used during peak flows and under emergency situations. An alternate to building a new plant would be to negotiate a new agreement to allow the Town to supplement demand and increase their use of water from Citizens Energy. A feasibility study would have to be performed to determine the likelihood of this alternative being possible. Recently CEG gave territory to the Town due to current pressure issues.

The cost of this option is unknown, but would be a continued monthly cost to the Town. Rates would most likely have to be increased to allow the town to keep up with maintenance of the distribution system and infrastructure improvements to CEG's system as well as the Town's existing booster station and water transmission main.

4.1.3 Alternative 3: No Action

The no action alternative involves maintaining the current status quo. Without the proposed 3.0 MGD water treatment plant, water storage tanks, and distribution system upgrades, any future growth will be based upon the ability to purchase more water from CEG. Otherwise, a moratorium would be placed on the Town, and no future customers could be added onto its system.

There is no measurable capital costs associated with the No Action alternative. However, there are long-term costs associated with the No Action plan and is based upon an agreement of purchasing water from CEG. This would be a continued monthly cost to the Town.

4.2 COMPARISON OF ALTERNATIVES

Each of the identified alternatives is compared for selection based on the following qualities:

Monetary evaluation considers the capital cost of construction for the proposed alternative.

Technical function is the ability to perform to the level determined by the engineering and scientific calculation

Reliability is the ability to be depended upon.

Ability to Implement considers how practical and feasible the alternative is to proceed.

Environmental Impacts consider the negative impact to the environment that could occur with the execution of a given alternative.

Table 4.2.1 provides a matrix for comparison of alternatives identified for each proposed project component. The scoring system for alternatives includes a scale of 1 to 5, with 5 being the most advantageous, and 1 the lowest value or least desirable. Scores in each category are determined subjectively by the engineer. Based on this methodology, the alternative with the highest accumulation of points would be the best alternative.

Table 4.2.1 - Alternative Evaluation Matrix

Parameter	*Alternative #1 New WTP*	*Alternative #2 New Agreement*	*Alternative #3 No Action*	*Comments*
Monetary	*1*	*3*	*5*	*Alternative #2 will result in increased operational cost and low system reliability*
Technical	*5*	*2*	*1*	
Reliability	*5*	*3*	*3*	*The existing plant is currently reliable; however as it ages and demand requires additional run time the plant will require significant maintenance.*
Ability to Implement	*5*	*1*	*3*	*Construction of a new water treatment plant and supply wells will be adjacent to the same location of the existing wells and treatment plants. They can operate until construction of the improvements are complete. Additionally, the ability to implement the New Agreement may not be possible.*
Environmental Impacts	*4*	*3*	*4*	*The proposed new water treatment plant, wells will be in previously disturbed areas will not damage or destroy any environmental concerns.*
Total	***20***	***12***	***16***	

Alternative Comparison

The recommended alternative for the Town is to construct a new water treatment plant and additional supply wells. This alternative is superior to the new agreement and no action alternatives in all areas except for cost. The proposed new water treatment plant and supply wells will benefit the Town in many ways, and will save significant repair costs as well as wholesale water costs. It will also allow the Town to continue to grow and provide safe, reliable drinking water to customers in its service area.

CHAPTER 5: SELECTED PLAN AND SCHEDULE

5.1 WATERWORKS RECOMMENDATIONS

This report examines the various components of the Town's waterworks and identifies those components in need of replacement and/or upgrading. The immediate need for the Town is to increase water supply, treatment and storage facilities that are at capacity, so that the Town can continue to provide a safe, reliable drinking water source to its customers. This is achieved by constructing a new water treatment plant, new water supply wells, and new clear well water storage tank. These three (3) components of this project are recommended to be constructed to meet the current and future needs of Town as described in Chapter 2 and Chapter 3 of this report.

5.2 NEW WATER TREATMENT PLANT, WATER SUPPLY WELLS & CLEAR WELL

The proposed new water treatment plant will be an iron and manganese removal plant with a 3.0 MGD capacity. The plant will generally be an automated process. Figure 5.2.1, Figure 5.2.2, and Figure 5.2.3 are conceptual site plans showing the water treatment plant improvements on the water plant site as well as the proposed changes to the well field and raw water lines. Two (2) new 800 gpm water supply wells will be constructed in the most suitable locations based upon the existing and new test well locations. A new raw water main will be constructed and tied into the existing raw water main and will provide the flexibility for any of the six (6) wells to provide water to either plants (existing Plant No. 1 and the proposed new plant). Sequential operation of the wells will be placed in a matrix so any of the six wells can be started and stopped in an operator selected sequence of operation. The well pump in the lead mode will start based on the water level in the proposed new 500,000 gallon clear well water storage tank located at the treatment plant site. A transducer will be located at the new clear well to sense water level. When the water level in the clear well drops to a preset level the two wells in the lead mode will start and pump to an aluminum induced draft aerator.

Water enters the top of the aerator and falls by gravity though the aerator. As raw water falls through the aerator trays, an induced draft aerator lifts air up through the falling water. The aeration step exposes the dissolved iron and manganese to oxygen that commences an oxidation process that causes the iron and manganese to precipitate out of solution into a state that allows removal by settlement in detention tanks.

Water exiting the aerator falls down into two 40,000 gallon weld steel detention tanks with special coatings. Using two tanks gives flexibility in operation and maintenance, allowing for one tank to be out of service for cleaning out precipitate or recoating, while continuing water production through the second tank still in service. The detention tanks, which serve as a reaction basin provide 30 minutes of detention time for the aerated water. This detention time is consistent with the Ten States Standards for oxidation of iron and manganese control. This 30 minute detention time facilitates the oxidation process between the iron and oxygen and the manganese and oxygen. At the end of 30 minutes the iron oxide and manganese oxide are in the form of a solid and are ready for removal by filtration.

Water exiting the detention tanks gravity flows into three horizontal low pressure filters with two cells per filter. The filters will be welded steel with special coatings. The proposed filters would minimize the amount of automatic valves, valve operators, and face piping. The filters would be operated at approximately 3.0 gpm per square foot of surface area. This filter rate is consistent with the acceptable range in the Ten States Standards for filtration of iron and manganese control. Using the horizontal low pressure filters would allow ninety percent of the filter to extend outside of the water treatment plant and minimize the size of the water treatment plant building. The finished water is pumped from the filter unit to the distribution system with high service pumps located inside the building. Each of the three horizontal end piped low pressure filters will operate in parallel and at a pressure of approximately 32 feet or 14 psi. This low pressure will allow the horizontal end piped filters not to be ASTM pressure rated vessels.

After the water has been filtered, the water will exit the filters through the finished water face piping and gravity flow to the new 500,000 gallon finished water clear well. The clear well will be constructed of welded carbon steel with special coatings, or spirally wound concrete. The selected tank will be determined during the design process. The clear well will serve as a location to provide contact time for the chlorine and water storage prior to entering the water distribution system. The high service pumps, 600 gpm, 1,200 gpm, and two 1,600 gpm respectively, will take suction from the clear well prior to pumping water into the water distribution system. The high service pumps will have variable frequency drives that will increase power efficiency and give operational flexibility to better meet the diurnal flow demands of the system.

A 2,700 gpm backwash pump will take suction from the new clear well for backwashing the horizontal end piped filters. The backwash waste water will be directed to a new wet well holding tank at the new water treatment plant site, and will be pumped to the existing gravity sanitary sewer system.

Chlorine gas and polyphospates will be added at the water treatment plant. A chlorine and water solution will be injected for disinfection as pre chlorination ahead of the filters and as post chlorination in the finished water ahead of the high service pumps. As a safety precaution, an automatic halogen shut-off system will be installed and will automatically shut-offs the gas cylinders in the event of a gas leak. In addition to the automatic halogen shut-off system a chlorine air scrubber will be installed as required by IDEM. In the event of a gas leak and in the event the automatic halogen shut-off system fails, the air scrubber unit is utilized to neutralize the chlorine gas. Metering pumps will be utilized for the pholyphosphate injection system. A chlorine residual analyzer will monitor chlorine concentration in the finished water to maintain a preset chlorine concentration in the finished water. Laboratory counter space and cabinets will be provided with the new project to perform routine chemical testing associated with this type of iron and manganese removal plant. A back-up diesel generator will be installed which will allow the Town to continue to operate primary equipment, two supply wells, and produce water during power outages.

The existing SCADA system can be modified to include the additional components necessary to integrate the proposed new 3.0 MGD water treatment plant into the waterworks system. A new SCADA system is proposed to be a part of the water treatment plant to monitor the water supply wells, water treatment plant, water booster stations and water storage tanks. The SCADA system will start and stop the well pumps. A transducer located in the clear well will send a 4 to 20 milliamp signal to the SCADA which will activate or deactivate the existing well motor starters located in the well fields. The SCADA system will monitor water levels in each of the elevated water storage tanks in the distribution system, and the new water treatment plant clear well. The SCADA system will monitor remaining amounts of chlorine and polyphospates in storage. The SCADA system will monitor and record raw water, finished water and backwash water at the water treatment plant. The SCADA system will monitor the status of each well pump, each high service pump, the backwash pump, chemical feed pumps, and booster station pumps. Continuous recording and monitoring of free chlorine and total chlorine will be accomplished by the SCADA system.

The project site for the Town's proposed 3.0 MGD water treatment plant is located immediately southeast of the intersection of East County Road 50 North and Columbia Street. The site is located to the north of the existing treatment plant and is on the north end of Ellis Park. Currently the area is utilized as a parking lot, an open field, and a trail runs through the area. A project site map is provided in Figure 5.2.1, Figure 5.2.2, and Figure 5.2.3. These figures show the locations of the existing water treatment plant and wells, as well as the new sites for the new water treatment plant and proposed wells. Connections to the existing raw water supply from the wells and the existing finished water mains will be required and will all be located on the water treatment plant site.

Figure 5.2.1 – Existing Plant, Proposed Plant, and Well Field

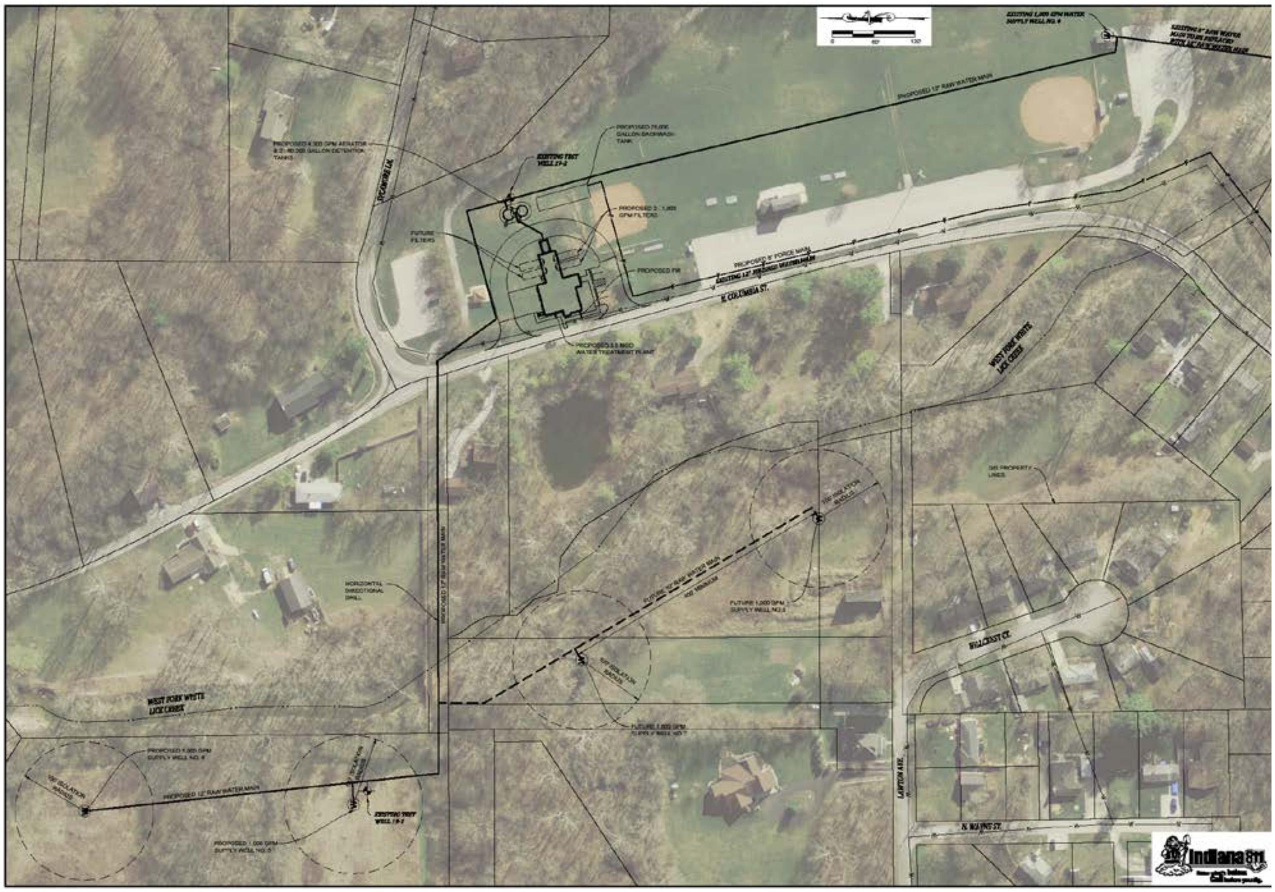


Figure 5.2.2 – Proposed Treatment Plant and Additional Wells

Figure 5.2.3 – Future Upgrades to Existing Well Field

5.3 COST ESTIMATES

The construction cost estimates herein represent the anticipated cost of improvements based on the current cost of construction in 2020. Cost estimates include the cost of materials, labor, overhead and profits for a contractor normally engaged in this type of work. Variables such as economic factors or construction contingencies could affect the final cost of improvements.

5.3.1 WATER TREATMENT PLANT

The preliminary construction cost estimate for the recommended water treatment plant, two (2) supply wells, and clear well in Table 5.3.1. Total estimated construction cost for the treatment plant is $8,346,750.00.

Table 5.3.1 – Summary of Estimated Costs

Total estimated project costs include the cost of construction plus the non-construction expenses. Non-construction costs include items such as engineering, construction observation, contract administration, legal, accounting, administrative, and miscellaneous items of cost. Table 5.3.1 provides the selected plan cost summary which includes estimated non-construction costs. The estimated total project cost for the selected project is $10,016,100.00.

				MASTER PLAN ESTIMATE	
ITEM NO.	ITEM	UNITS	QTY.	UNIT PRICE	TOTAL PRICE
1	8" C900 PVC BACKWASH FORCE MAIN	L.F.	1400	$ 65.00	$ 91,000.00
2	10" C900 PVC RAW WATER MAIN	L.F.	640	$ 70.00	$ 44,800.00
3	DIRECTIONAL DRILL 12" C900 PVC RAW WATER MAIN TO NEW WELLS (CREEK CROSSING)	L.F.	300	$ 175.00	$ 52,500.00
4	12" C900 PVC RAW WATER MAIN TO NEW WELLS	L.F.	2070	$ 85.00	$ 175,950.00
5	12" CL350 DUCTLE IRON RAW WATER MAIN REPLACEMENT	L.F.	1000	$ 95.00	$ 95,000.00
6	DIRECTIONAL DRILL 12" C900 PVC RAW WATER MAIN REPLACEMENT (CREEK CROSSING)	L.F.	465	$ 175.00	$ 81,375.00
7	24" DIAMTETER, 1,000 GPM GRAVEL PACK WELL, PUMP & MOTOR	EACH	2	$ 150,000.00	$ 300,000.00
8	WELL ELECTRICAL	LUMP SUM	1	$ 125,000.00	$ 125,000.00
9	45,000 GALLON STEEL DETENTION TANKS	EACH	2	$ 250,000.00	$ 500,000.00
10	1,000 GPM STEEL HORIZONTAL LOW PRESSURE FILTERS	EACH	2	$ 200,000.00	$ 400,000.00
11	4,000 GPM AERATOR	EACH	1	$ 150,000.00	$ 150,000.00
12	1,200 GPM HIGH SERVICE PUMP & MOTOR	EACH	2	$ 40,000.00	$ 80,000.00
13	1,600 GPM HIGH SERVICE PUMP & MOTOR	EACH	1	$ 50,000.00	$ 50,000.00
14	STEEL PUMP CAN	EACH	4	$ 15,000.00	$ 60,000.00
15	2,700 GPM FILTER BACKWASH WATER PUMP	EACH	1	$ 35,000.00	$ 35,000.00
16	LOW PRESSURE SEWER SYSTEM	LUMP SUM	1	$ 30,000.00	$ 30,000.00
17	CHLORINATION SYSTEM	EACH	1	$ 60,000.00	$ 60,000.00
18	CHLORINE LEAK DETECTOR	EACH	1	$ 15,000.00	$ 15,000.00
19	AUTOMATIC HALOGEN SHUT-OFFS	EACH	4	$ 10,000.00	$ 40,000.00
20	CHLORINE AIR SCRUBBER UNIT	EACH	1	$ 65,000.00	$ 65,000.00
21	STANDBY POWER GENERATOR PLANT & ATS	EACH	1	$ 200,000.00	$ 200,000.00
22	MOTOR CONTROL CENTER	EACH	1	$ 260,000.00	$ 260,000.00
23	AUTOMATIC CONTROL CIRCUITS	LUMP SUM	1	$ 250,000.00	$ 250,000.00
24	YARD PIPING AND VALVES	EACH	1	$ 400,000.00	$ 400,000.00
25	MASONRY BUILDING	LUMP SUM	1	$ 800,000.00	$ 800,000.00
26	WATER PLANT PIPING AND VALVES	EACH	1	$ 500,000.00	$ 500,000.00
27	SITE GRADING, SOIL EROSION CONTROL	LUMP SUM	1	$ 150,000.00	$ 150,000.00
28	DRIVES AND SIDEWALKS	LUMP SUM	1	$ 125,000.00	$ 125,000.00
29	LABORATORY EQUIPMENT	LUMP SUM	1	$ 10,000.00	$ 10,000.00

30	*COMPRESSOR & AIR PIPING*	*LUMP SUM*	*1*	*$ 25,000.00*	*$ 25,000.00*
31	*SCADA*	*LUMP SUM*	*1*	*$ 225,000.00*	*$ 225,000.00*
32	*PAINTING*	*LUMP SUM*	*1*	*$ 75,000.00*	*$ 75,000.00*
33	*SECURITY*	*LUMP SUM*	*1*	*$ 75,000.00*	*$ 75,000.00*
34	*500,000 GALLON CONCRETE CLEAR WELL*	*LUMP SUM*	*1*	*$ 1,000,000.00*	*$ 1,000,000.00*
35	*CHEMICAL FEED*	*LUMP SUM*	*1*	*$ 75,000.00*	*$ 75,000.00*
36	*FILTERED WATER MAG METERS*	*LUMP SUM*	*1*	*$ 20,000.00*	*$ 20,000.00*
37	*FINISHED WATER MAG METERS*	*LUMP SUM*	*1*	*$ 30,000.00*	*$ 30,000.00*
38	*BACKWASH TANK LIFT PUMPS*	*LUMP SUM*	*1*	*$ 35,000.00*	*$ 35,000.00*
39	*75,000 GALLON CONCRETE BACKWASH WASTE TANK*	*LUMP SUM*	*1*	*$ 250,000.00*	*$ 250,000.00*
ESTIMATED CONSTRUCTION COST					*$ 6,955,625.00*
CONSTRUCTION CONTINGENCY (20%)					*$ 1,391,125.00*
TOTAL ESTIMATED CONSTRUCTION COST					*$ 8,346,750.00*
SURVEY, GEOTECHNICAL, ENVIRONMENTAL, ARCHITECTURAL, ENGINEERING, PERMITTING, BIDDING, CONSTRUCTION & CONTRACT ADMINISTRATION, OBSERVATION (15%)					*$ 1,252,012.50*
LEGAL, FINANCIAL, OTHER NON-CONSTRUCTION (5%)					*$ 417,337.50*
TOTAL PROJECT COST					*$ 10,016,100.00*

5.3.2 DISTRIBUTION SYSTEM

The distribution system will have to be upgraded to supply water to the projected service areas shown in the previous chapters. The following are general distribution system upgrades that would have to occur when development takes place. Most likely, the majority of the costs will be taken on by the developers. A map of the future distribution system is shown below in Figure 5.3.1. Figure 5.3.2 shows the water main extensions on the east side of Town, Figure 5.3.3 shows the water main extensions on the southeast side of Town, and Figure 5.3.4 shows the water main extensions on the west side of Town.

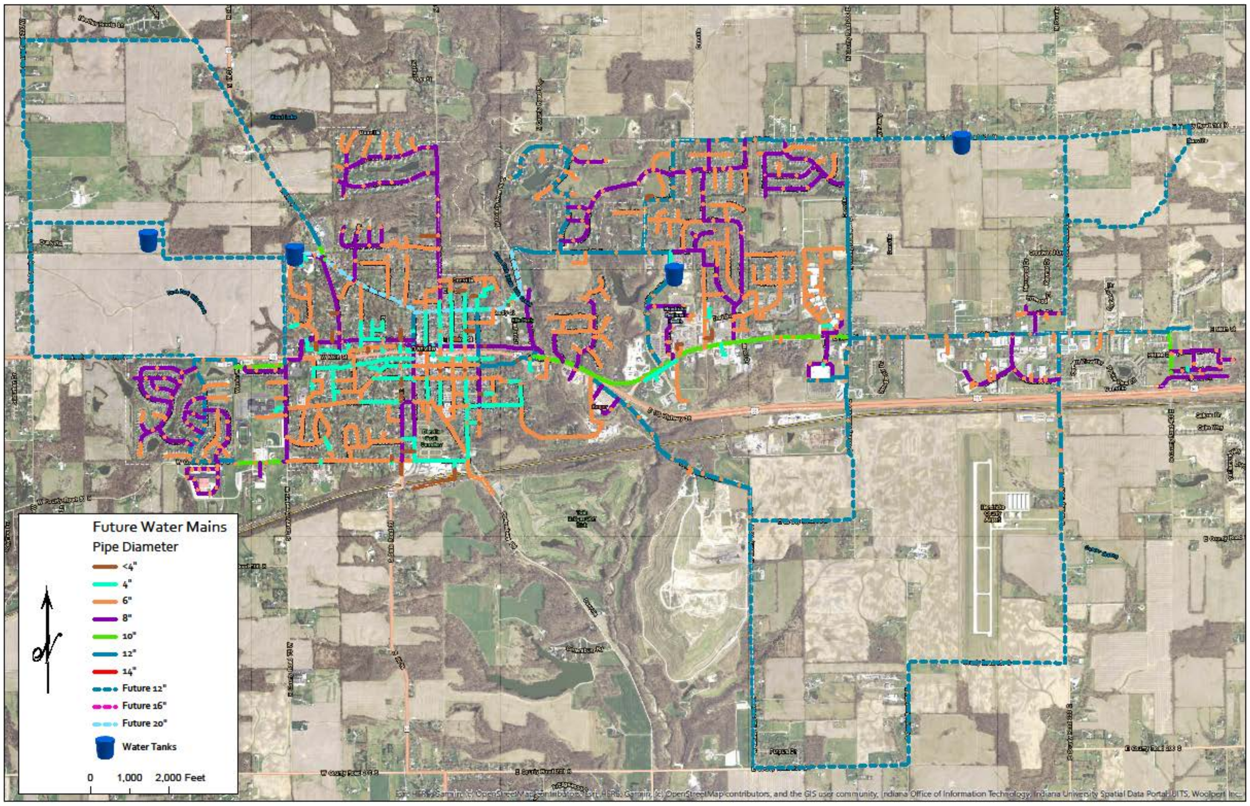


Figure 5.3.1 – Future Distribution System

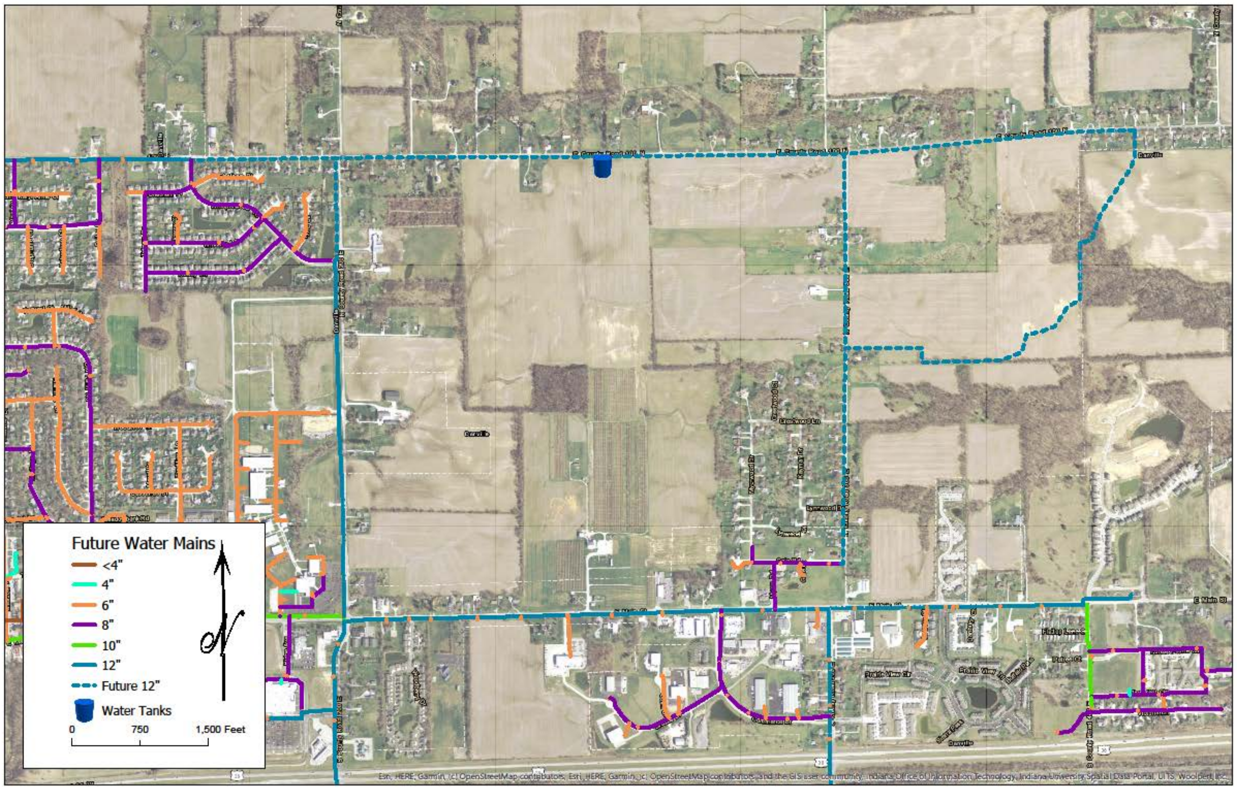


Figure 5.3.2 – East Water Main Extensions

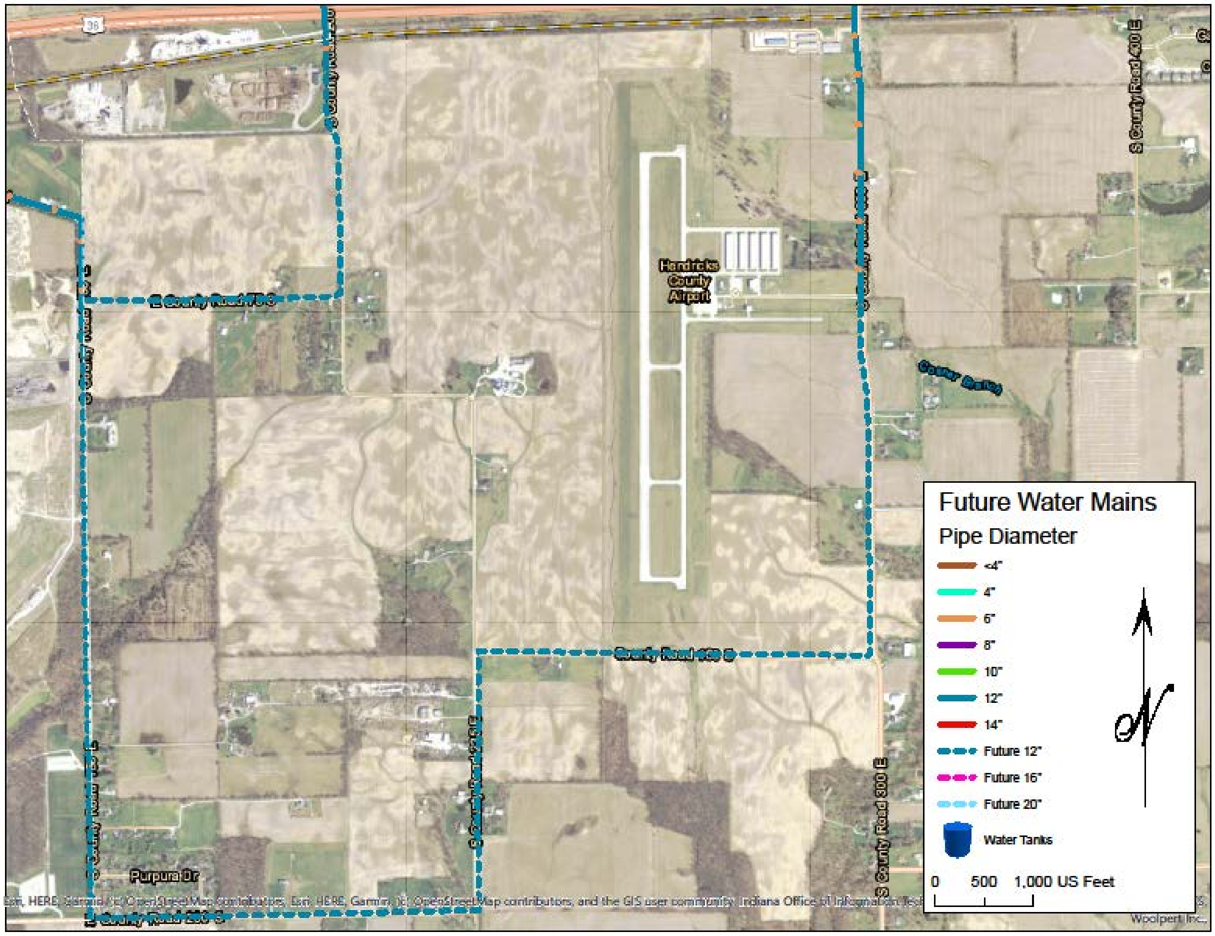


Figure 5.3.3 – Southeast Water Main Extensions

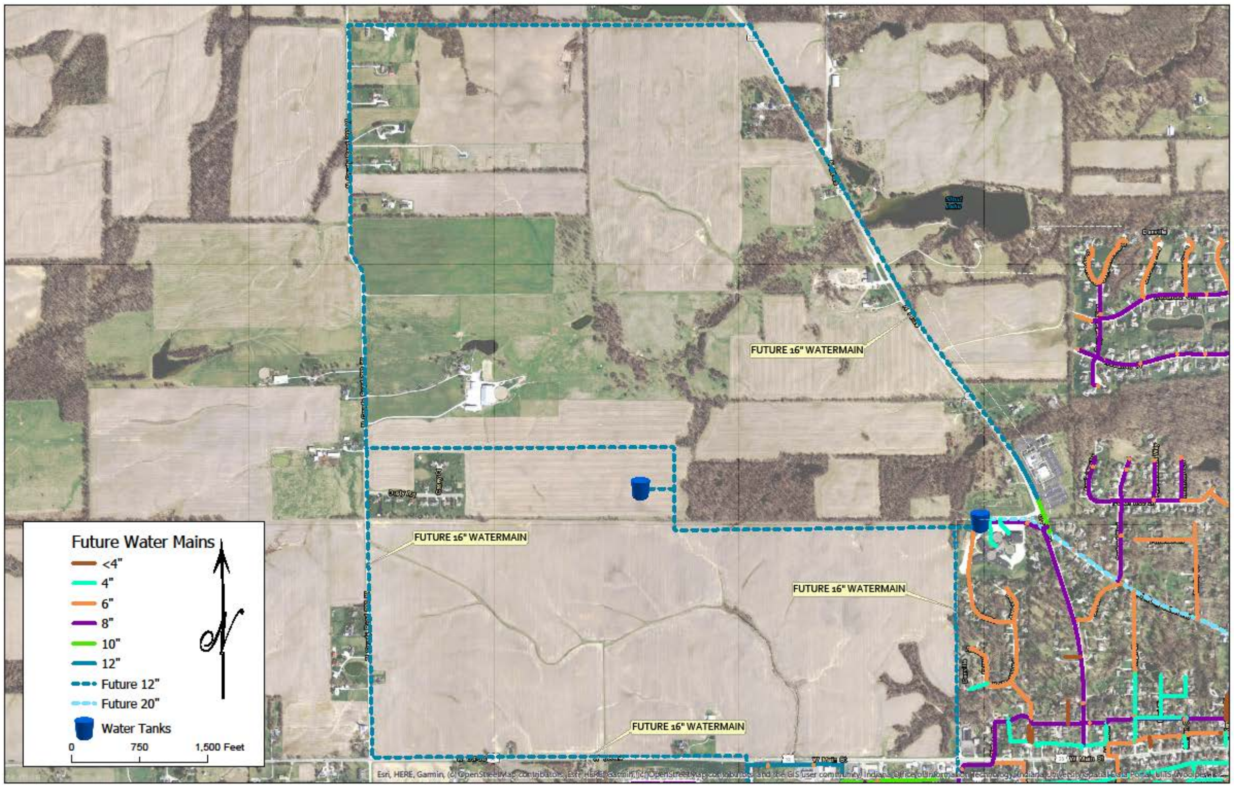


Figure 5.3.4 – West Water Main Extensions

Table 5.3.2 - Southern West Loop

	ITEM	COST ESTIMATE
a	18,320 LF of 16” DI	$1,715,000
	SUB-TOTAL	$1,715,000
	CONSTRUCTION CONTINGENCY @ 20%	$343,000
	TOTAL CONSTRUCTION	$2,058,000
	NON-CONSTRUCTION CONTINGENCY @ 20%	$412,000
	TOTAL ESTIMATED COST	**$2,470,000**

Table 5.3.3 – Estimated Cost of Northern West Loop

	ITEM	COST ESTIMATE
a	14,800 LF of 16" DI	$1,384,000
	SUB-TOTAL	$1,384,000
	CONSTRUCTION CONTINGENCY @ 20%	$276,800
	TOTAL CONSTRUCTION	$1,660,800
	NON-CONSTRUCTION CONTINGENCY @ 20%	$332,000
	TOTAL ESTIMATED COST	**$1,992,800**

Table 5.3.4 – Estimated Cost of Large Southeast Loop

	ITEM	COST ESTIMATE
a	20,650 LF of 12" DI	$1,512,000
	SUB-TOTAL	$1,512,000
	CONSTRUCTION CONTINGENCY @ 20%	$302,400
	TOTAL CONSTRUCTION	$1,814,400
	NON-CONSTRUCTION CONTINGENCY @ 20%	$363,000
	TOTAL ESTIMATED COST	**$2,177,400**

Table 5.3.5 – Estimated Costs of Small Southeast Loop

	ITEM	COST ESTIMATE
a	4,915 LF of 12" DI	$360,000
	SUB-TOTAL	$360,000
	CONSTRUCTION CONTINGENCY @ 20%	$72,000
	TOTAL CONSTRUCTION	$432,000
	NON-CONSTRUCTION CONTINGENCY @ 20%	$86,000
	TOTAL ESTIMATED COST	**$518,000**

Table 5.3.6 – Estimated Costs of Eastern Loops

	ITEM	COST ESTIMATE
a	14,085 LF of 12" DI	$1,030,000
	SUB-TOTAL	$1,030,000
	CONSTRUCTION CONTINGENCY @ 20%	$206,000
	TOTAL CONSTRUCTION	$1,236,000
	NON-CONSTRUCTION CONTINGENCY @ 20%	$247,000
	TOTAL ESTIMATED COST	**$1,483,000**

Table 5.3.7 – Estimated Cost of Main Extension from New Plant to Elementary Tank

	ITEM	COST ESTIMATE
a	7,450 LF of 20” DI	$950,000
b	West Booster Station Upsizing	$350,000
	SUB-TOTAL	$1,300,000
	CONSTRUCTION CONTINGENCY @ 20%	$260,000
	TOTAL CONSTRUCTION	$1,560,000
	NON-CONSTRUCTION CONTINGENCY @ 20%	$312,000
	TOTAL ESTIMATED CONSTRUCTION COST	**$1,872,000**

Table 5.3.8 – Estimated Cost of Water Tanks

	ITEM	COST ESTIMATE
a	1.0 MG Elevated Spheroid	$2,150,000
b	0.75 MG Elevated Spheroid	$1,550,000
	SUB-TOTAL	$3,700,000
	CONSTRUCTION CONTINGENCY @ 20%	$740,000
	TOTAL CONSTRUCTION	$4,440,000
	NON-CONSTRUCTION CONTINGENCY @ 20%	$888,000
	TOTAL ESTIMATED COST	**$5,328,000**

The total estimated cost of the collection systems upgrades is $15,841,200.

5.4 PROJECT SCHEDULE

Table 6.4.1 is the recommended proposed schedule for the recommended plan for the treatment plant, clearwell, and supply wells.

Table 5.4.1 – Proposed Project Schedule

Project Component	***Time Frame***
Install 2-3 Test Wells	*Spring 2020*
Funding Applications, Survey, Design, and IDEM Permitting	*Spring 2020 – Winter 2020*
Bidding	*Winter 2020*
Construction Commences	*Spring 2021*
Substantial Completion	*Fall 2022*

WELL-FIELD CAPACITY EVALUATION

TOWN OF DANVILLE, INDIANA

Prepared for:

Banning Engineering PC

Prepared by:

Eagon & Associates, Inc.
Worthington, Ohio

November 7, 2019

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2247

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INTRODUCTION

The purpose of this report is to present the results of an analysis of the capacity of the Danville, Indiana Well Field in Hendricks County. The Town of Danville currently operates four wells at the well field. Well and well-field locations are shown on Figure 1 and well construction details are summarized on Table 1. Well logs and well construction diagrams are included in Appendix A.

Total water use has averaged between approximately 800,000 and 850,000 gallons per day (gpd) since 2012. Peak day demand was 1.6 million gallons per day (MGD) in 2014. The water treatment plant (WTP) capacity is 2.0 MGD. Overall demand is expected to increase in the near future due primarily to residential development.

The groundwater capacity analysis presented in this report is based on well performance data from pumping tests of the wells, historical water-level data, and review of area well logs and available geological data from the Indiana Department of Natural Resources (IDNR) and the Indiana Geological Survey (IGS).

The report includes recommendations for additional test drilling and water-level monitoring to provide information that can be used to refine the groundwater capacity estimates provided in this report and to evaluate the potential for well-field expansion.

HYDROGEOLOGIC SETTING

Geology

Danville is located in the Tipton Till Plain physiographic region in the White River basin (Fenelon, et. al., 1994). In this glaciated portion of the state, multiple advances and retreats of continental ice sheets have resulted in the present thickness of glacial drift (sand, gravel, silt and clay) that ranges from about 100 to over 150 feet in the Danville area. The land surface over most of the area is relatively flat, with the greatest topographic relief resulting from incision by West Fork White Lick Creek. Wells at the Danville Well Field are completed in a buried glacial outwash aquifer that occurs between approximately 100 feet below ground level (bgl) and the bedrock surface. The aquifer is generally associated with the West Fork White Lick Creek valley and has a relatively narrow east-west extent. Figure 2 shows graphic logs of the four Danville production wells and the two test borings that were completed in 2019. Well logs for the wells and test borings are included in Appendix A. The graphic logs show that there is very little sand or sand and gravel above 100 feet, bgl and the aquifer materials below 100 feet, bgl are stratified and include layers of clay at most of the well locations. Test boring 19-2 shows very little sand and gravel and appears to be at a location that is east of the main aquifer. Areas peripheral to the main (thickest) part of the aquifer will contribute water to pumping wells, but are not suitable for installation of high capacity wells.

Underlying the glacial deposits in this region is siltstone, shale and limestone bedrock of the Mississippian Age Borden Group. The bedrock aquifer is utilized for residential purposes, where unconsolidated aquifers are not present, but does not yield enough water for municipal or commercial purposes. Bedrock topography is shown on Figure 3. The bedrock surface contours shown on Figure 3 are from the IGS modified using site-specific data from the Danville Well Field. The aquifer in which the Danville wells are completed generally coincides with a bedrock topographic low that trends generally from southeast to northwest along the trend of West Fork White Lick Creek.

The aquifer transmissivity from evaluation of data from a 24-hour pumping test of Well 3R in June 2013, shown on Figure 4, is about 105,700 gallons per day per foot (gpd/ft). The aquifer thickness at the well field, based on the logs of wells and test borings, is about 40 feet. The hydraulic conductivity of the aquifer materials (transmissivity divided by thickness) is about 2,642 gpd/ft^2, which is a reasonable value for aquifer hydraulic conductivity.

Recharge Potential

Recharge to the buried glacial outwash aquifer in the Danville area is considered to be primarily from infiltration of precipitation. Recharge rates are dependent on the thickness of glacial till (an unsorted unstratified mix of sand, gravel, silt and clay having a generally low permeability) overlying the aquifer, the degree and depth of weathering in the till and surface topography that influences surface-water runoff. Recharge rates in the Danville area are unlikely to exceed one to two inches per year.

WATER USE AND WATER LEVELS

Total average daily water withdrawal for Danville between 1984 and 2018 is shown on Figure 5. Water use has been on an upward trend since 1994 and has increased from about 450,000 gpd to over 885,000 gpd in 2018. The lower water withdrawal between 2004 and 2011 does not reflect total water use. The water treatment plant was being upgraded during that time period and water was purchased from Citizens Water/Indianapolis to meet demand. Peak daily demand was approximately 1.6 MGD in 2014, which is 80 percent of the 2.0 MGD WTP capacity.

Water-level data from Wells 1, 2 and 3/3R are shown on Figure 6. As noted on the graph, Well 3 was replaced by Well 3R in 2013. Static (i.e. non-pumping) water levels were in the range of about 12 to 25 feet in 2008 and 2009. Water withdrawal during this period was about 500,000 gpd (0.5 MGD). Since 2016, static water levels have varied from about 30 to 45 feet and water withdrawal has increased to between 800,000 to 885,000 gpd.

Because of the design and construction of Well 4, water levels cannot be measured. Well 4 is constructed as a vacuum well. As shown on the well construction diagram in Appendix A, a six-inch diameter, 11foot long blank section of pipe is attached to the top of the well screen. A packer is situated between the six-inch diameter pipe and the well casing. The well head is also sealed. When the well pumps, no drawdown occurs in the well. Well performance can only be monitored by comparing the vacuum pressure with the original vacuum pressure (five inches at

700 gpm). If the well screen is plugging, the vacuum will be higher at the same pumping rate. A reduction in the pumping rate will also indicate a problem with the pump or the well screen. While no drawdown occurs in the well, drawdown will occur in the aquifer outside of the well just as it would with a conventional well design.

WELL-FIELD CAPACITY EVALUATION

As a first look at the capacity of the Danville well field, short (one day) and long-term (180 days) drawdowns were calculated and maximum pumping rates were determined based on available drawdown and assuming no recharge. This evaluation is shown on Table 2. The pumping rates (900 and 1,000 gpm) shown in the upper section of Table 2 are based on well capacities registered with IDNR and maximum pumping rates from flow tests of Wells 1, 2 and 3R performed in 2018 and 2019 by Bastin Logan Water Services. Based on the pumping rates of the wells, the maximum pumping capacity with the best well out of service is 4.0 MGD.

The height of the water column in each well was determined using static depth to water measurements at the time that flow tests were performed in 2018 and 2019, except for Well 4. The available drawdown is the difference between the static depth to water and the top of the well screen. Since water levels cannot be measured in Well 4, the depth to water used for Well 4 is the approximate average of depth to water measurements from Wells 1, 2 and 3R. Sustainable drawdown is considered to be 70 percent of the feet of water above the top of the well screen for Wells 1, 2 and 3R. This leaves an allowance of 30 percent of the water column above the well screen remaining for loss of well efficiency and seasonal low water levels.

Because Well 4 is a vacuum well, there is no drawdown in the well and the sustainable drawdown is equal to the available drawdown. Plugging of the well screen would eventually lead to a reduction in pumping rate and drawdown in the aquifer immediately outside of the well casing would be less.

The short-term pumping well drawdown for each well shown on Table 2 is based on the specific capacity from the 2018 and 2019 flow tests and 24-hour drawdown from the constant-rate pumping test of Well 3R in 2013. Graphs of specific capacity from Wells 1, 2 and 3R are included in Appendix B. Interference drawdown (drawdown between wells) was estimated by creating a theoretical distance drawdown graph, included as Figure 7. The theoretical drawdown calculations are based on a transmissivity of 105,700 gpd/ft, from the Well 3R pumping test, and a storativity of $5x10^{-4}$. Data are not available to calculate a site-specific storativity value. The value used is a reasonable value for a confined aquifer. As shown on Figure 7, theoretical distance-drawdown curves were calculated for one day and 180 days at pumping rates of 900 and 1,000 gpm. 180 day pumping levels were based on extrapolation of time-drawdown data from the constant-rate pumping test of Well 3R. It is worth noting that the time-drawdown data from the Well 3R pumping test do not show a downward deflection in the drawdown trend that would indicate that the cone-of-influence had encountered a negative aquifer boundary. Therefore, longer-term drawdown projections do not account for limitations in the extent of the aquifer.

Well loss is drawdown in a well due to the turbulent flow of water as it enters the well that results in a lower water level in the well than in the aquifer outside of the well. Well loss in a sand and gravel well can be due to naturally occurring grain-size variation of the aquifer materials and removal of finer grained material near the well screen during well development. Well loss is not constant over time and varies directly with pumping rate. The values of drawdown due to well loss used for this analysis and shown on Table 2 were calculated from the most recent flow test data for Wells 1, 2 and 3R. Well loss is not relevant for Well 4, since there is no drawdown in the well itself.

Pumping well drawdown, interference drawdown and well loss were combined to determine total drawdown for the one day and 180 day scenarios. The total drawdowns were compared to the sustainable and available drawdowns and individual well pumping rates were adjusted proportionally to estimate the total sustainable and peak capacities.

The limitations of this analysis are that it does not account for the limited east-west extent of the aquifer and the limited recharge that is likely available to support long-term withdrawal from this deep buried aquifer, resulting in overestimation of the true well-field capacity. Recharge of two inches per year is equivalent to approximately 100,000 gallons per day per square mile. To sustain a withdrawal of 5.0 MGD, the cone-of-influence due to pumping would have to capture recharge over an area of 50 square miles.

As an approximation it can be assumed that aquifer boundaries could double the slope of the time-drawdown trend and the well-field capacity could be 50 percent of the values shown on Table 2. This approach results in more realistic well-field capacity estimates of about 4.2 to 5.3 MGD for one day and 2.9 to 3.6 MGD for 180 days.

Another method to estimate well-field capacity utilizes the water-withdrawal data, shown on Figure 5, and the water-level data, shown on Figure 6. In 2008 and 2009, water withdrawal averaged approximately 500,000 gpd. The static depth to water over that same time period averaged about 18.5 feet. Between 2012 and 2018, water withdrawal increased to an average of about 845,000 gpd and the depth to water averaged around 37.5 feet. These data indicate a decline in aquifer water levels of about 19 feet in response to an increase of water withdrawal of about 345,000 gpd. This equates to a change in water levels of 0.055 feet per 1000 gpd increase in water withdrawal. Using the sustainable and total available drawdowns and estimating the available increase in pumping capacity for each well based on the historical water level response to increased pumping results in a long-term sustainable capacity of 2.3 MGD and a peak capacity of 3.9 MGD.

Recommendations for Exploration and Testing

In order to investigate the potential for increasing the well-field capacity, we recommend additional test drilling and aquifer testing. Potential test drilling locations are shown on Figure 8 and include additional drilling on Town property north of Test Boring 19-1 and west of the creek north of the eastern extension of the Lawton Drive right-of-way. The right-of-way itself is not wide enough to meet the Indiana Department of Environmental Management (IDEM) sanitary setback radius of at least 100 feet. That does not restrict the Town from drilling a test boring, but if suitable aquifer is encountered lease or purchase of additional property would be necessary. We recommend that an option be obtained from the owner of the property north of the right-of-way so that a test boring can be completed at a location that meets the sanitary setback requirement. The location shown on Figure 8 is 100 feet north of the southern limit if the right-of-way. Lease or purchase of property for a raw water main would also be necessary to get water to the WTP, if a well were developed at that location.

Aquifer materials of suitable thickness and grain size were encountered at Test Boring 19-1. Also shown on Figure 8 is a potential test boring location 300 feet north of 19-1. Test drilling anywhere on the eastern side of Town property north of 19-1 is possible, but 300 feet is the closest that we would recommend if two wells were developed on the Town property west of the creek. It is important to stay near the creek. The bedrock topography map (Figure 3) shows the bedrock elevation increasing to the west and the logs of several wells along Washington Street did not encounter sand and gravel.

Piezometers should be installed at test boring locations with suitable aquifer materials so that they can be used as observation wells. Based on the test drilling results, a location should be selected for installation of a test/production well. The grain-size data for Test Boring 19-1 are shown on Figure 9. Analysis of the grain-size data indicates that a gravel pack well with a 0.050-inch slot well screen can be installed at this location. In order to maximize the well screen transmitting capacity, we recommend a 24-inch diameter well screen and casing set in a 36-inch diameter borehole. Based on the well log, the screen should be set between 138 and 161 feet, bgl. The transmitting capacity of 23 feet of Johnson Hi-Flow 24-inch pipe-size well screen is 1,697 gpm at the design well screen entrance velocity of 0.1 foot per second. Our standard practice is to assume that 50 percent of the well screen open area is blocked by gravel pack material so the optimal maximum well capacity would be about 800 gpm to avoid excessive entrance velocities.

The selected test well should be used for performance of a 72-hour constant-rate pumping test. A 72-hour test is recommended because the 24-hour pumping test of Well 3R did not indicate any negative aquifer boundary conditions. A longer test interval may provide data that will show the aquifer response to boundary conditions and provide a better indication of the long-term aquifer response to pumping. Water-level data collected during the test can be used to analyze aquifer properties and can provide data that can be used to determine the potential increase in well-field capacity that could be realized with additional wells.

Other options for groundwater capacity development would require additional exploration at locations more distant from the WTP. Regional aquifer mapping indicates that more continuous aquifer may be present south of the existing well field. However, the presence of the Twin Bridges Landfill precludes expansion into areas along the West Fork White Lick Creek south of U.S. Route 36. Any exploration to the south would need to be southwest or southeast of the existing well field and at a sufficient distance from the landfill and any other known or potential sources of contamination.

CONCLUSIONS AND RECOMMENDATIONS

1. Based on the evaluation presented in this report, the sustainable capacity of the Danville Well Field with the existing wells is approximately 2.5 MGD with a peak capacity of 3.5 MGD. The sustainable capacity is approximately 2.7 times current average daily demand and the peak capacity is over twice the historical peak capacity. Any significant increase in water withdrawal should be accompanied by adequate water-level monitoring to ensure that pumping withdrawals do not exceed available recharge.

2. This well-field capacity analysis is based on well performance data from 2018 and 2019. Declines in well performance will reduce the usable capacity of the wells. The wells should be cleaned on a routine basis to maintain individual well capacities and the ability to meet increasing groundwater demands.

3. Static and pumping water-levels in the wells should be measured on a regular basis. These data not only are useful for evaluation of long-term water level trends, as has been done in this report, but can also indicate declining well performance and the need for well maintenance.

4. An observation well should be installed at the well field and should be equipped with a pressure transducer and datalogger set to monitor water levels on an hourly basis. Data collected from an observation well show the response of the aquifer to recharge and withdrawal without the effect of well performance and can be used to further refine well-field capacity estimates.

5. Additional exploratory drilling should be performed west of the West Fork White Lick Creek to identify locations for potential future production wells. Spreading wells over a wider area can allow for capture of recharge over a larger area and an increase in the capacity of the well field.

6. A test/production well should be installed at one of the test boring locations and should be used to perform a long-term (72 hour) aquifer test. Water-level data collected during the test can be used to further analyze aquifer properties and to observe the drawdown trend over time in the aquifer. These data can then be used to refine the well-field capacity estimates presented in this report.

7. Any additional groundwater exploration will need to be further from the existing well field and WTP. Possible locations are further north along the creek or southeast or southwest of the existing well field. The presence of the Twin Bridges Landfill south of U.S. Route 36 prohibits exploration to the south along the creek.

REFERENCES

BEDROCK_TOPOGRAPHY_MM36_IN: Bedrock Topography Contours, Indiana (Indiana Geological Survey, 1:500,000, Line Shapefile), by original author and compiler Henry H. Gray, digital representation by Chris Dintaman, David A. Held, and Kimberly H. Sowder, 2003.

Driscoll, F.G., 1986. Ground Water and Wells. Published by Johnson Division, St. Paul, Minnesota, Second Edition. Library of Congress Catalog Card No. 85-63577

Fenelon, Joseph M.; Kieth E. Bobay, and others, 1994, Hydrogeologic Atlas of Aquifers in Indiana, U.S. Geological Survey Water Resources Investigations Report 92-4142.

FIGURES

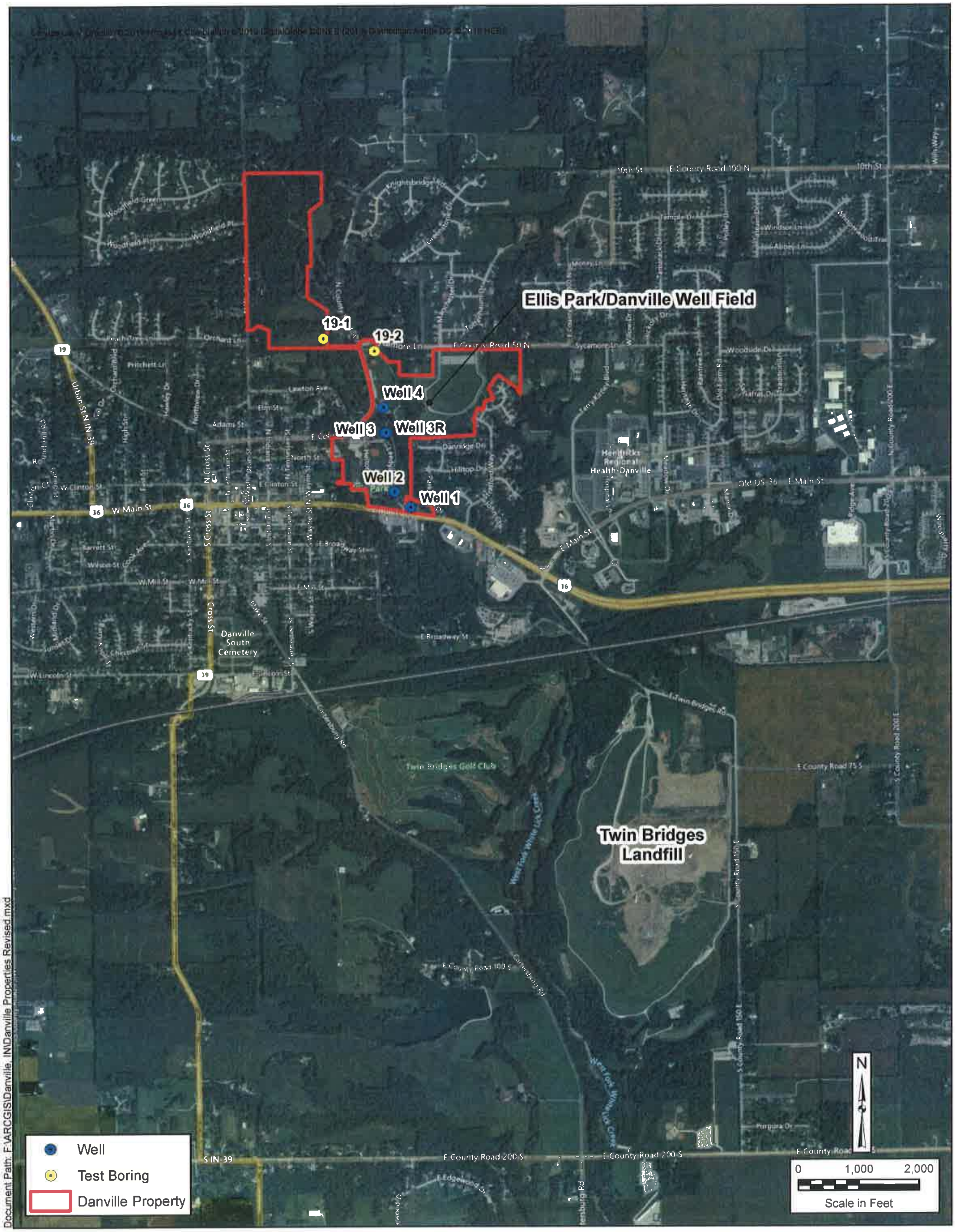

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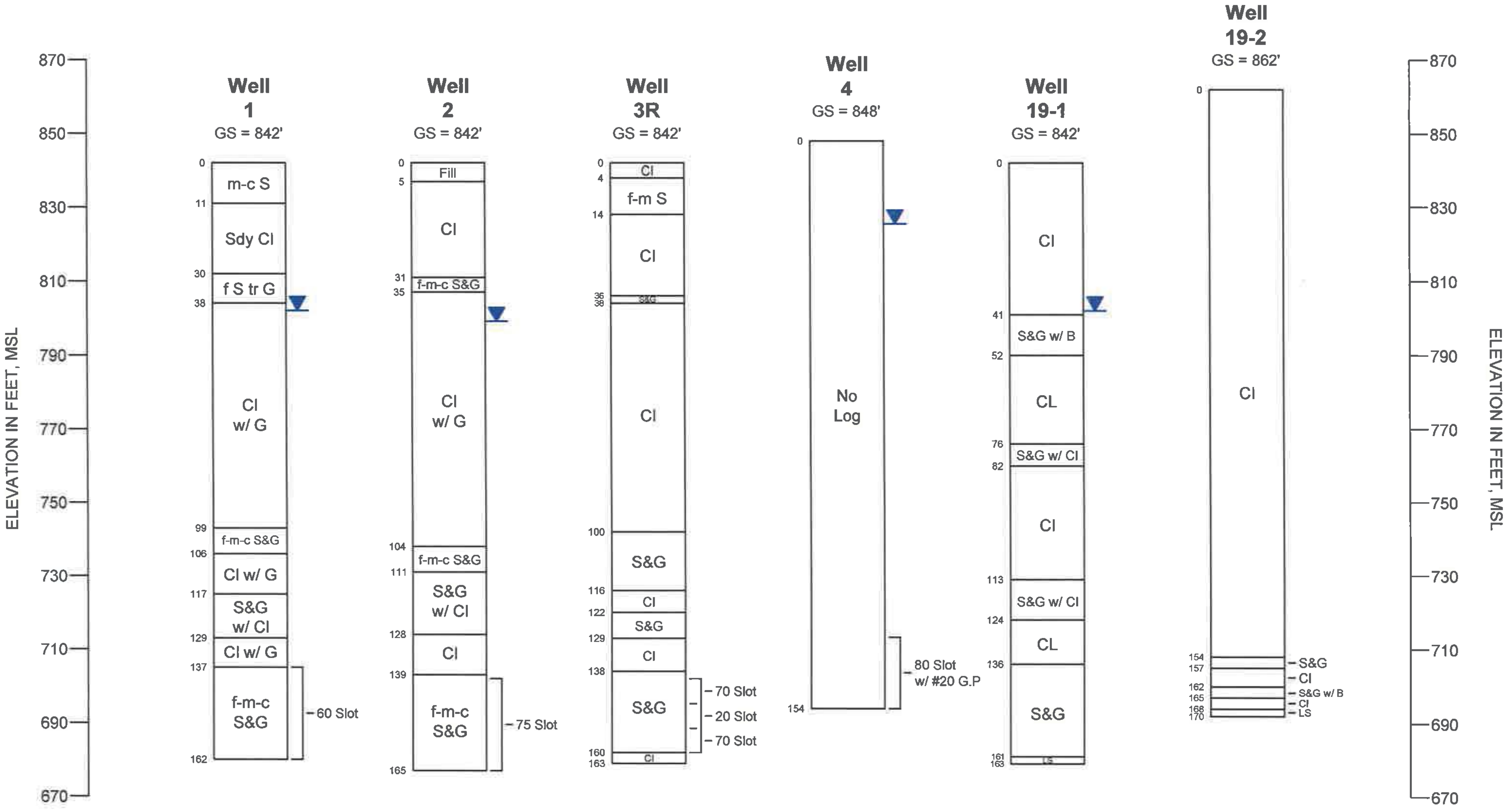
Figure 1. Well Field Location Map, Danville Indiana



LEGEND

Cl	Clay	Sdy	Sandy
S	Sand	w/	with
G	Gravel	tr	Trace
B	Boulders	f-m-c	Fine-Medium-Coarse
S&G	Sand & Gravel	▼	Water Level
LS	Limestone		

NO HORIZONTAL SCALE
VERTICAL SCALE - 1in = 40ft

COMPILED BY: SJC
DRAFTED BY: MAM
CHECKED BY: SJC
APPROVED BY: SJC
DATE: 11/5/19
FIGURE TITLE: GRAPHIC LOGS
PROJECT TITLE: DANVILLE, IN
PREPARED BY: EAGON & ASSOCIATES, INC.
FIGURE NUMBER: 2

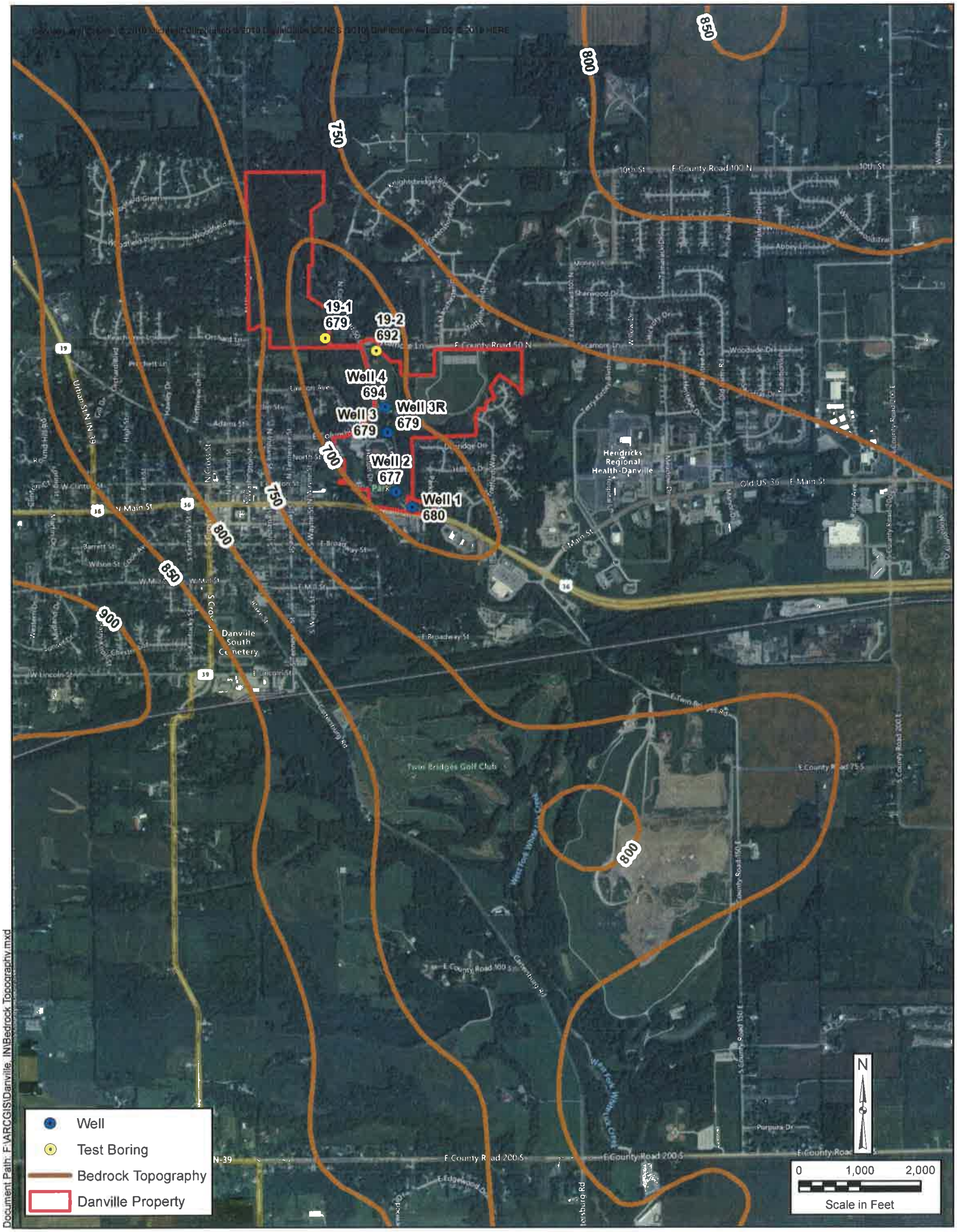


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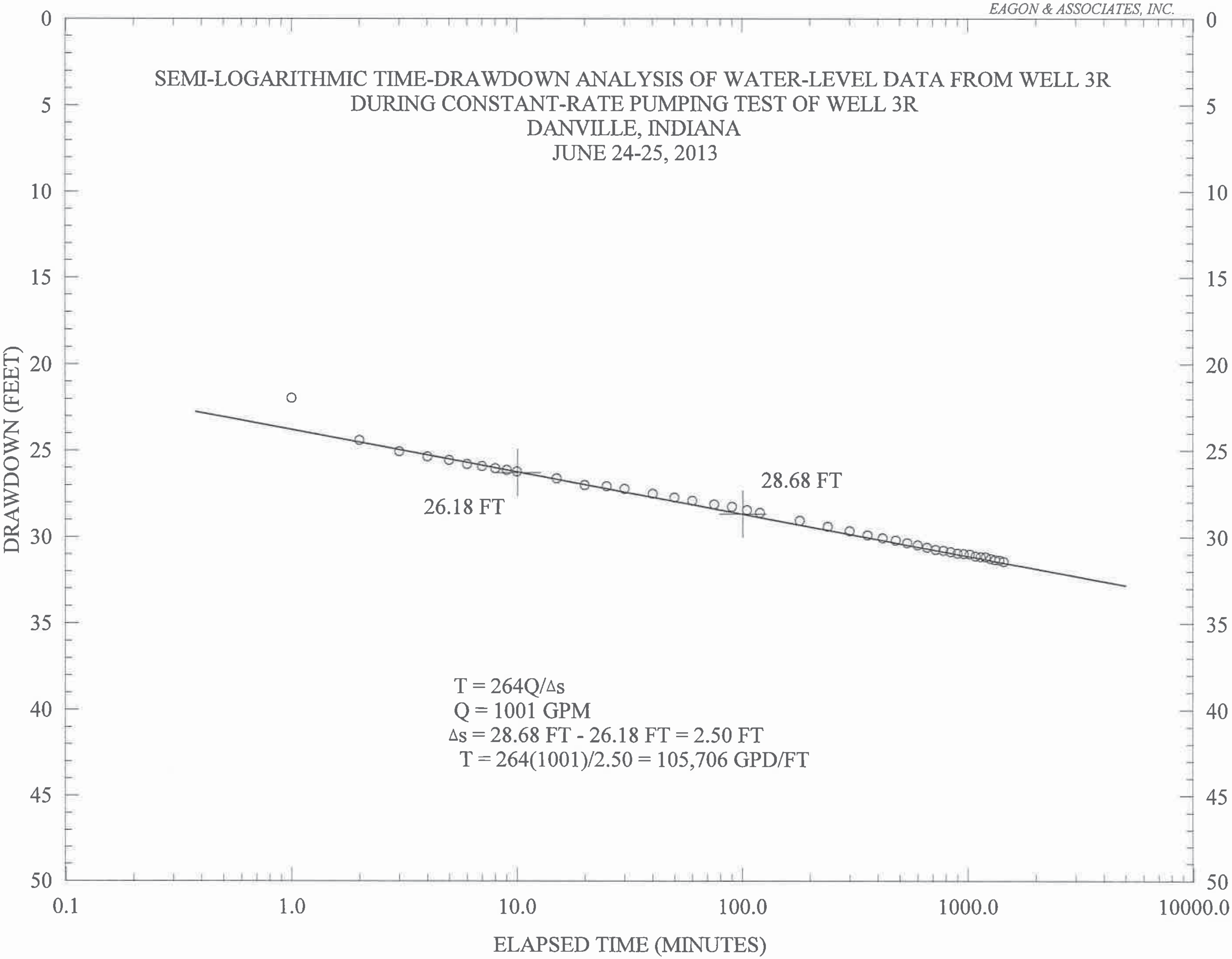
Figure 3. Bedrock Topography



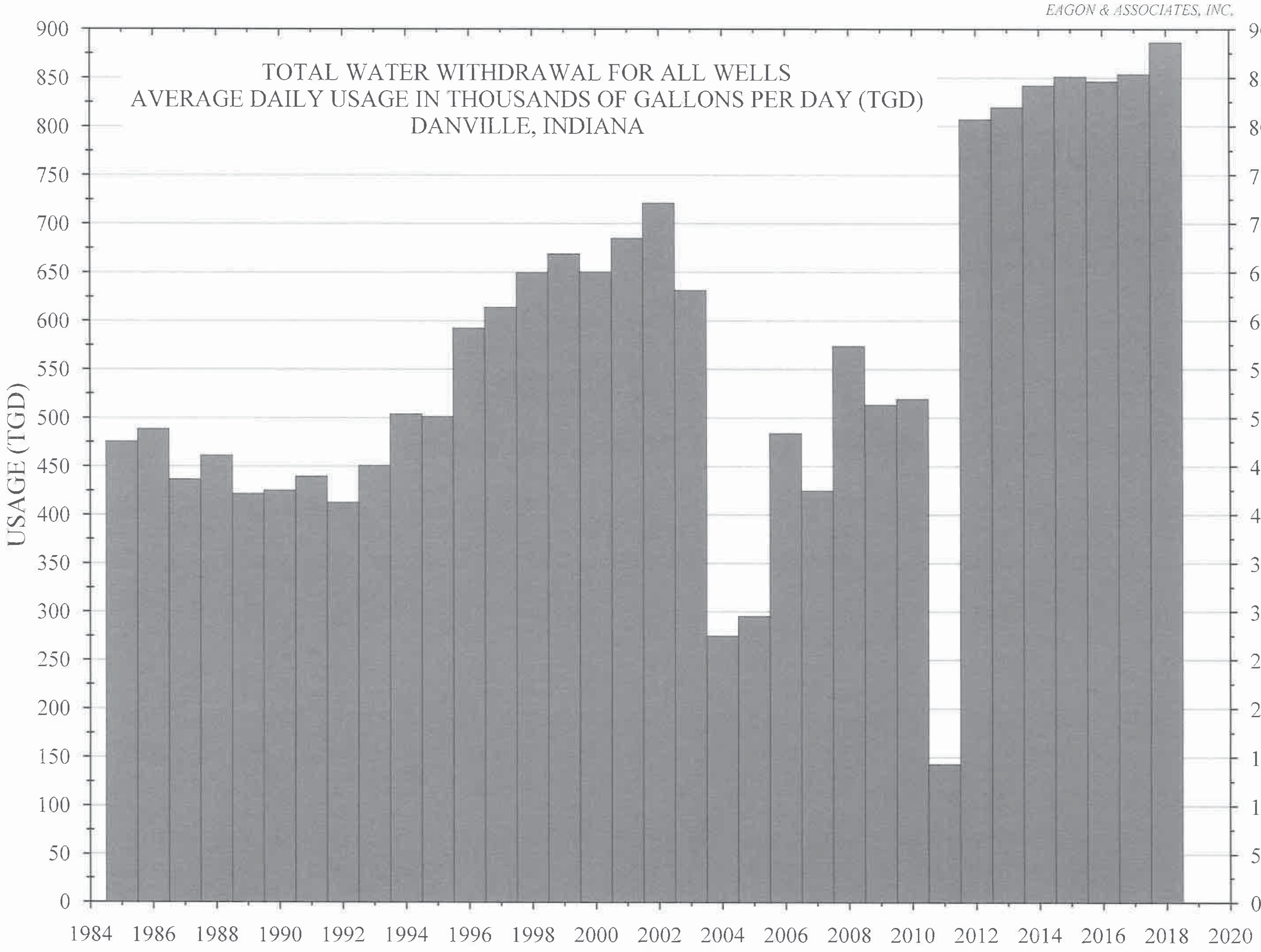
EAGON & ASSOCIATES, INC.

SEMI-LOGARITHMIC TIME-DRAWDOWN ANALYSIS OF WATER-LEVEL DATA FROM WELL 3R
DURING CONSTANT-RATE PUMPING TEST OF WELL 3R
DANVILLE, INDIANA
JUNE 24-25, 2013

T = 264Q/Δs
Q = 1001 GPM
Δs = 28.68 FT - 26.18 FT = 2.50 FT
T = 264(1001)/2.50 = 105,706 GPD/FT

DANVILLE IN/WELL3R/WELL3RSL3RPT.GRF

FIGURE 4.



DANVILLE/TOTALAVERAGEDAILY ALLWELLS.GRF
11/5/2019

FIGURE 5.

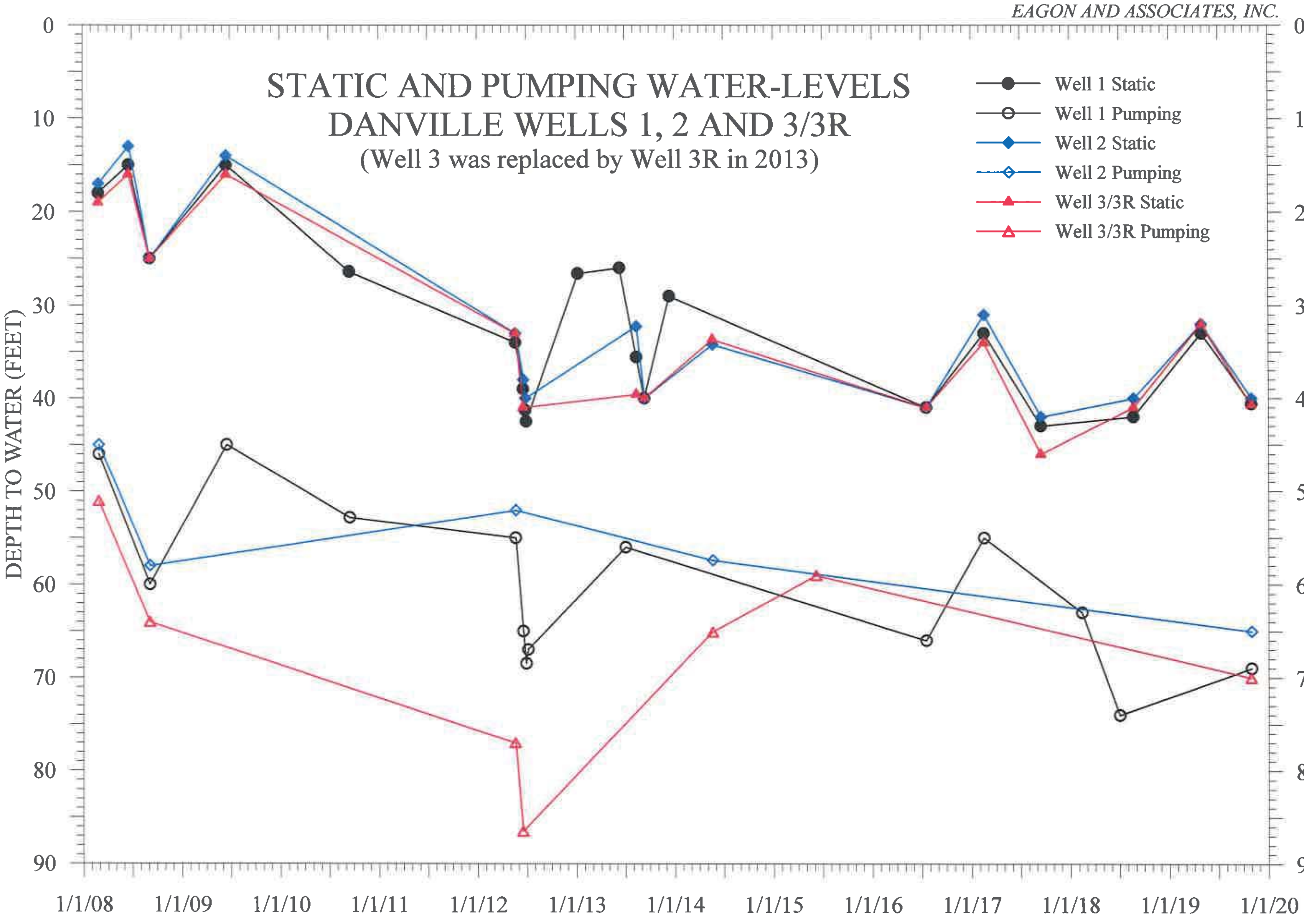
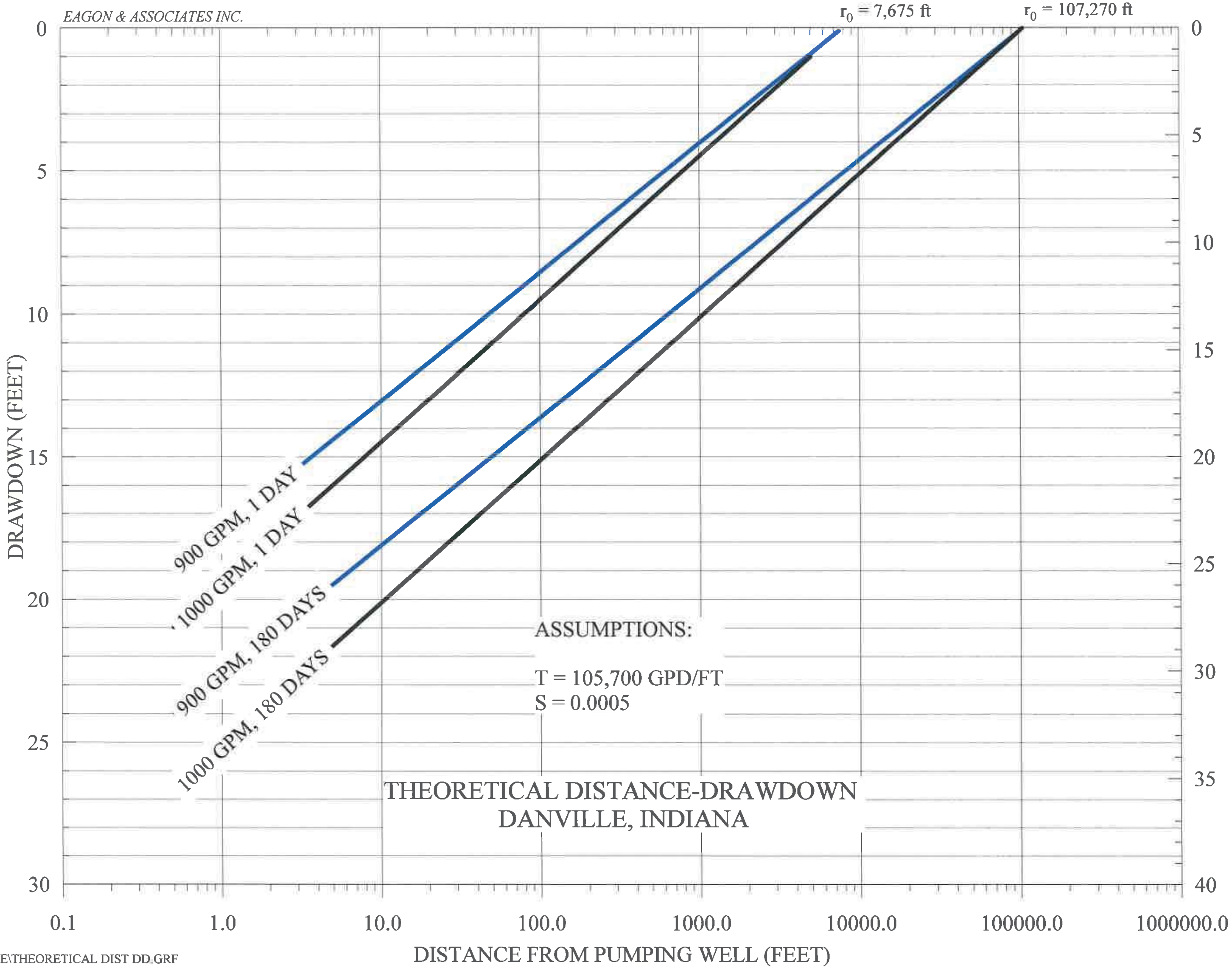


FIGURE 6.

DANVILLE/ STATIC & PUMPING WLS.GRF
11/5/19



DANVILLE\THEORETICAL DIST DD.GRF
11/5/2019

FIGURE 7.

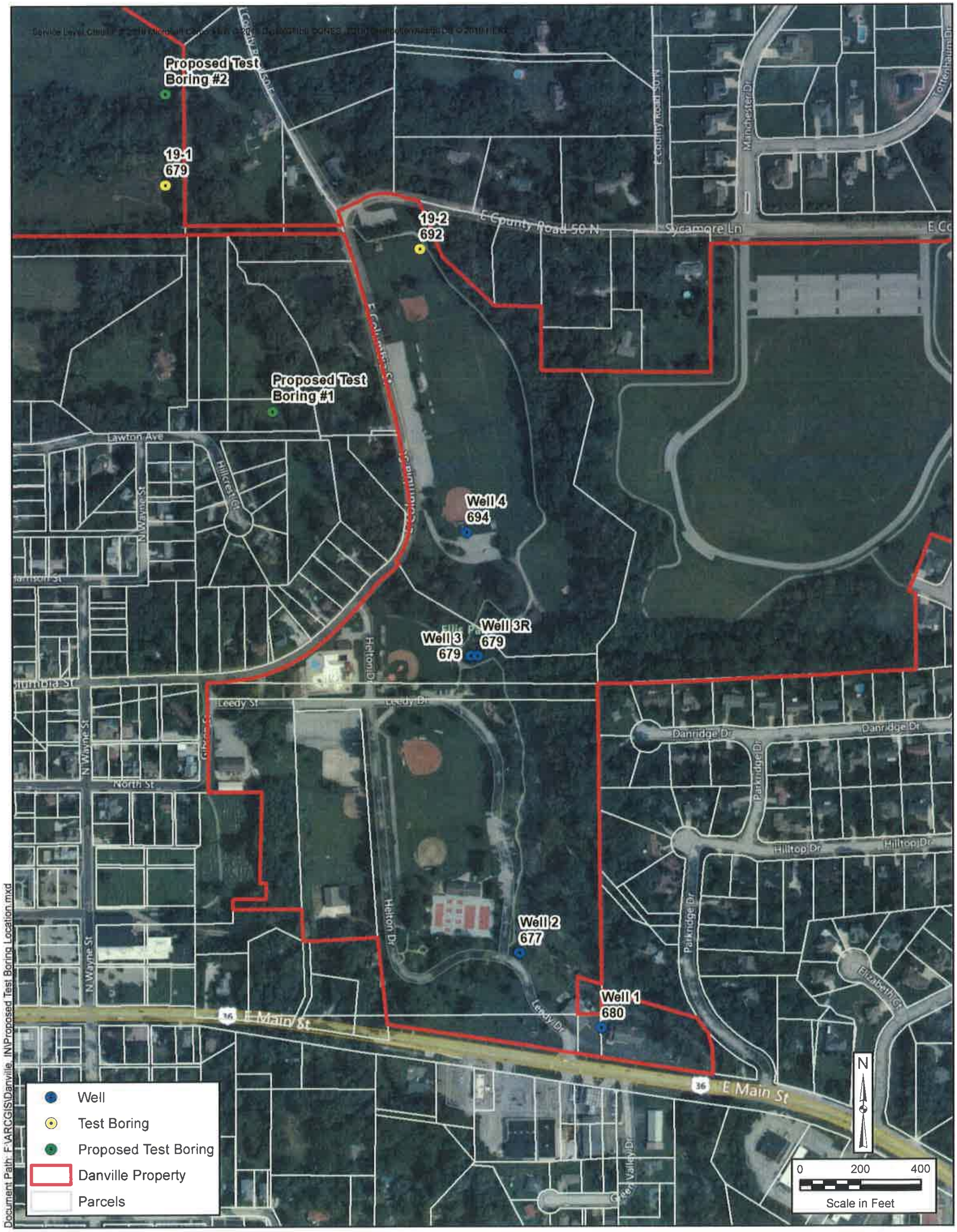
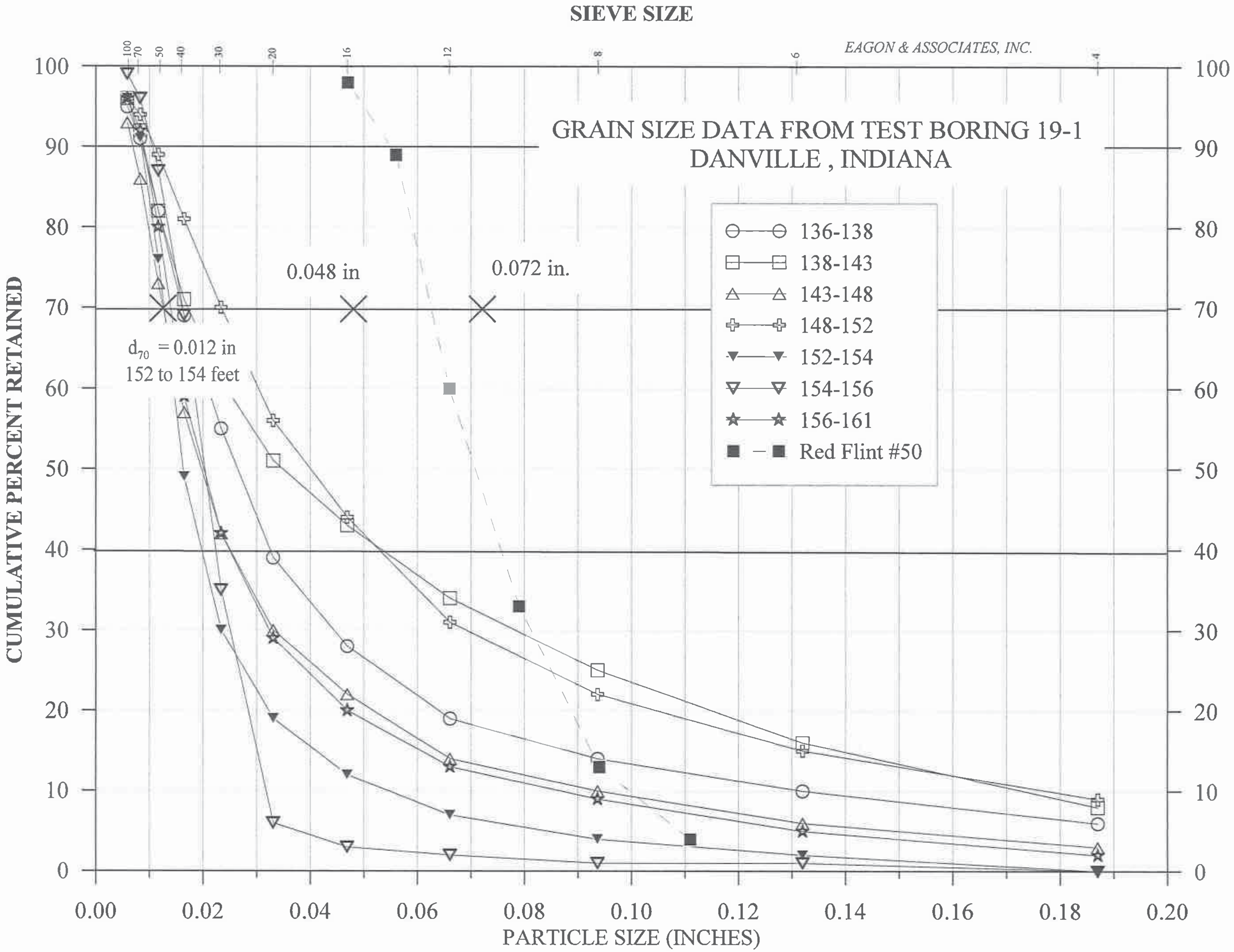


Figure 8. Well and Test Boring Locations, Danville Indiana



DANVILLE IN/19-1 SCREEN & GRAVEL PACK SIZE.GRF
11/5/19

FIGURE 9.

TABLES

TABLE 1.
WELL CONSTRUCTION SUMMARY
DANVILLE, INDIANA

Well No.	Well Depth (feet, bgl)	Casing Diameter (inches)	Screen Diameter (inches)	Screen Length (feet)	Screen Slot-Size (inches)	Gravel Pack Material
1	157	20	20 Telescoping	25	0.060	NA
2	165	20	20 Telescoping	25	0.075	NA
3R	160	20	20 Telescoping	21	0.070 - 139' to 147' 0.020 - 147' to 153' 0.070 153' to 160'	NA
4	154	20	6 Pipe Size	20	0.080	Red Flint #20

Well 4 is a vacuum well equipped with a 14' 4" long sealed packer set above the well screen.

TABLE 2.
GROUNDWATER CAPACITY ANALYSIS
DANVILLE, INDIANA WELL FIELD

	Ellis Park/Danville Well Field					
Well Number:	1	2	3R	4*	Total (gpm)	Total (MGD)
Ground Surface Elevation (feet, msl)	842	842	842	846		
Top of Well Screen (feet, bgs)	137	140	139	134		
Static Water Level (feet, bgs)	37.7	43.6	40.6	40		
Available Drawdown (feet)	99.3	96.4	98.4	94		
Sustainable Drawdown (70 percent of Available Drawdown, feet)	69.5	67.5	68.9	--		
Pumping Rate (gpm)	900	900	1000	1000	3,800	5.5
Pumping Period:	1 Day					
Interference Drawdown (feet)	13.46	14.45	14.10	12.89		
Pumping Well Drawdown (feet)	42.75	42.24	26.42	26.42		
Well Loss (feet)	8.67	4.07	5.00	--		
Total Drawdown (feet)	64.88	60.76	45.52	39.31		
Sustainable Capacity (gpm)	964	1000	1513	2391	5,868	8.5
Peak Capacity (gpm)	1377	1428	2162	2391	7,358	10.6
Pumping Period:	180 Days					
Interference Drawdown - 180 Days (feet)	29.57	30.72	29.94	28.65		
Pumping Well Drawdown (feet)	48.63	48.12	32.30	32.30		
Well Loss (feet)	8.67	4.07	5.00	--		
Total Drawdown (feet)	86.87	82.91	67.24	60.95		
Sustainable Capacity (gpm)	720	733	1024	1542	4,019	5.8
Peak Capacity (gpm)	1029	1046	1463	1542	5,081	7.3

*Well 4 drawdowns were taken from Well 3R since no pumping test information was available.

Sustainable capacity is the calculated pumping rate using 70 percent of available drawdown. This calculation allows for seasonal variation in water levels and loss of well efficiency over time.

Peak capacity is the calculated pumping rate using all available drawdown.

APPENDIX A.

WELL LOGS AND WELL CONSTRUCTION DIAGRAMS

Record of Water Well

Indiana Department of Natural Resources

Reference Number
363773

Driving directions to well
156' N OF US36, 45' S OF CREEK, 70' E OF ENTRANCE TO ELLIS PARK

Date completed

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	TOWN OF DANVILLE	DANVILLE, IN	
Driller	BASTIN LOGAN WATER SVC., INC.	237 W MONROE ST., FRANKLIN, IN	(317) 738-4577
Operator	DELFORD DUNN	License: null	

Construction Details

Well	**Use:**	**Drilling method:** Cable Tool	**Pump type:**
	Depth: 162.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 137.0	**Material:**	**Diameter:** 20.0
Screen	**Length:** 25.0	**Material:** SS WW	**Diameter:** 20.0 **Slot size:** .060

Well Capacity Test
Type of test: Pumping
Test rate: 15.0 gpm for 12.0 hrs.
BailTest rate: gpm for hrs.
Drawdown: 77.25 ft.
Static water level: 41.0 ft.
Bailer Drawdown ft.

Grouting Information
Material: BENT
Depth: from to
Installation Method:
Number of bags used:

Well Abandonment
Sealing material:
Depth: from to
Installation Method:
Number of bags used:

Administrative
County: HENDRICKS
Township: 15N **Range:** 1W
Section: NW of the SW of the SE of Section 3
Topo map: DANVILLE
Grant Number:
Field located by: DRILLER
on: Aug 08, 2002
Courthouse location by:
on:
Location accepted w/o verification by:
on:
Subdivision name:
Lot number:
Ft W of EL: 2550.0
Ft N of SL: 850.0
Ft E of WL:
Ft S of NL:
Ground elevation: 880.0
Depth to bedrock:
Bedrock elevation:
Aquifer elevation: 718.0
UTM Easting: 541605.0
UTM Northing: 4401337.0

Well Log

Top	Bottom	Formation
0.0	1.0	TOPSOIL
1.0	11.0	MED & CRS SAND
11.0	30.0	SANDY GRAY CLAY W/TRC GRAV
30.0	38.0	FN SAND, TRC GRAV
38.0	69.0	GRAY CLAY W/GRAV
69.0	74.0	HD GRAY CLAY W/BOULDERS
74.0	99.0	GRAY CLAY W/GRAV
99.0	106.0	FN MED CRS S&G LG ROCKS
106.0	117.0	GRAY CLAY W/GRAV
117.0	129.0	S&G MIX W/GRAY CLAY SHARP
129.0	137.0	SOFT GRAY CLAY W/GRAV
137.0	147.0	FN MED CRS S&G W/LG ROCKS
147.0	152.0	FN MED CRS S&G
152.0	162.0	FN MED CRS S&G W/TRC CLAY

Well 1

Comments

BASTIN LOGAN WATER SERVICES INC.

237 W. MONROE STREET
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

WELL FORMATION LOG

Town of Danville - Well # 2

☐ TEST

☒ PERMANENT

DATE	6/19/02	**State**	Indiana	**Project**	2287-F
Well No	2	**City**	Danville	**Section**	3
UTM	0541503E	**County**	Hendricks	**Twsp**	15N
UTM	4401404N	**Civil Twsp**	Center	**Range**	1W

OWNER: Town of Danville

LAND DESCRIPTION: 415 feet north of US 36, 25 feet west of creek

Street or Road Well is due north of entrance to Ellis Park

FORMATION	From Natural Ground Level			
	Depth to top of stratum(ft)	Depth to bot of stratum(ft)	Thickness of stratum(ft)	Static Water level(ft)
Top soil	0	1	1	
Fill dirt and sand	1	5	4	
Brown clay	5	12	7	
Gray clay with gravel	12	31	19	
Fine, medium and coarse sand and gravel	31	35	4	
Gray clay with gravel	35	72	37	43
Hard sandy gray clay	72	77	5	
Gray clay with gravel	77	104	27	
Fine, medium and coarse sand and gravel	104	111	7	
Sand and gravel strips of gray clay	111	128	17	
Gray clay with gravel	128	134	6	
Soft, sandy gray clay	134	139	5	
Fine, medium & coarse sand & gravel w/large rocks	139	151	12	
Fine, medium and coarse sand and gravel	151	156	5	
Fine, med & coarse sand & gravel w/large rocks - trace of clay	156	165	9	

Hole 20" dia. Drilled by Cable tool

Rotary Hole Grouted with Bentonite

Casing 20" OD from 24" above grade to 145' below grade. Weight 78.6

Screen 20" TELE set from 165 to 140 feet

Make Johnson Type SSWW Slot 0.075

Pumping Test 902 GPM drawdown to 77.25 feet after 12 hours pumping.

Driller(s) Delford Dunn

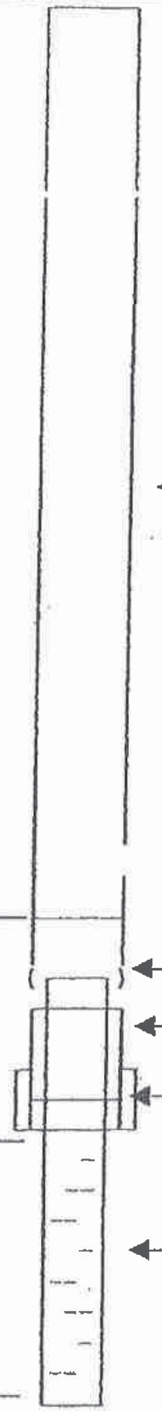
BASTIN LOGAN WATER SERVICES INC.

237 W. MONROE STREET
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Tubular Well Print

Town of Danville - Well # 2

Tower Height		
Pipe extends	3	feet above ground level.



Pipe size 20"

Wall Thickness 0.375

Depth 137'

K-packer expanded against pipe

Blank Tube Size

Length 3'

Steel Drive Shoe

Depth 140'

Well Screen

Type WW SS

Slot size 0.075

Depth 165'

Customer Information

Job #: 2287-F
Customer: Town of Danville
Tubular Well No: 2

Customer Location

Location from street or road:	
415' north of US 36	
25' west of creek	
UTM	16N 0541503E
UTM	4401404N
County	Hendricks
Township	Center
Section	3 T15N R1W
State	Indiana

Well Data

Static Water Level		47.69
Pumped	902	GPM at
78'	pumping level	
after	12	hours
Drawdown		29.31
Specific Capacity		30.78

Driller(s):

Delford Dunn

Date Completed: 6/19/02

BASTIN LOGAN WATER SERVICES INC.

237 W. Monroe Street
P.O. Box 55
Franklin, IN 46131
Ph: (317) 738-4577
Fax: (317) 738-9295

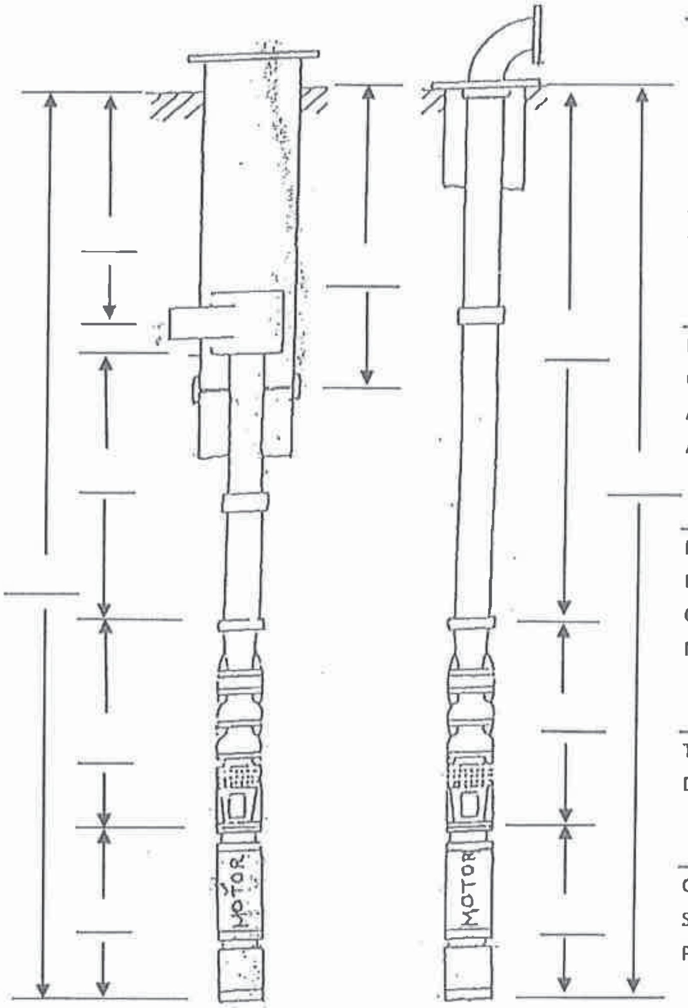
Submersible Pump Installation Report

Town of Danville - Well #2

Project No: 3747-F **Well No.** 2 **Date** 6/4/2014
Client Town of Danville **City** Danville **State** Indiana
Location of Well 415' north of Hwy 36 and west of WTP

Motor

Make	Flowserve	**Diameter**	6"	**Model #**	M87004	**Serial #**	330367505
HP	40	**Volts**	460	**Phase**	3	**Cycles**	60
RPM	1760	**Full Load Amp**	57	**Ser. Factor**	1.15	**S.F. Amps**	



PUMP

Discharge:

Mfg	Maas	Model	18
Flgd Elbow		Pitless Adap.	x
Pitless Tank		Tank Cap	
Discharge pipe size	8"	Col Con sz	8"
Adapter connected to well casing			below ground
with			

COLUMN

Pipe Size	8"	Pipe mat'l	Steel
Col. Check valve type	in vault		
Airline length			
Air intake valve type		located	

PUMP BOWL

Mfgr	J-Line	Type	12IC-2
Diameter	12"	Stages	2
Cable Size	6 awg	Length	
Model Number	122381		

WELL

Type	Tubular	Diameter	20"
Depth	141'	Screen Lgth	20'-0"

PUMPING TEST

GPM		Pumping Lev	
SWL			
Pressure		Amp Reading	

Remarks: New pitless J-rings - 2014
Well cleaned 2014

Installers: John Britton
Andy Patton

BASTIN LOGAN WATER SERVICES INC.

237 W. MONROE STREET
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Well Formation Log

Town of Danville - Well #3R

☐ **TEST**	**DATE**	5-20-13	***State***	Indiana	***Project***	3621-F
	Well No	3R	***City***	Danville	***Section***	3
☐ **PERMANENT**	**UTM 16S**	541466	***County***	Hendricks	***Township***	15N
	UTM	4401676	***Civil Twsp***		***Range***	1W

OWNER	Town of Danville
LAND DESCRIPTION	1,200' north of park entrance - 320' east of Helton Drive
Street or Road	

FORMATION	From Natural Ground Level			
	Depth top of stratum (ft)	Depth bottom of stratum (ft)	Thickness of stratum	Static Water level
Top soil and brown clay	0	4	4	
Fine medium sand	4	14	10	
Gray clay	14	17	3	
Gray clay w/ gravel	17	32	15	
Gray clay w/ gravel & rocks	32	36	4	33.65
Fine medium coarse sand & gravel	36	38	2	
Gray clay w/fine medium coarse sand	38	67	29	
Gray clay, fine medium coarse gravel - lg rocks 3-4"	67	77	10	
Hard clay w/fine medium gravel	77	99	22	
Silty clay	99	100	1	
Fine medium coarse sand & gravel	100	101	1	
Fine medium sand	101	105	4	
Fine medium coarse sand & gravel	105	116	11	
Clay w/ gravel	116	122	6	
Fine medium sand	122	123	1	
Fine medium coarse sand & gravel,3-4" rocks-boulder	123	125	2	

Hole 20" **dia** **Drilled by** Cable Tool

Rotary Hole Grouted with

Casing 20" **OD from** 2'-0" **above grade to** 139' **below grade.**

Screen 20" Tele. **set from** 139' **to** 160' **feet** **Weight** 78.67

Make Johnson **Type** SSWW Hi-Flow **Slot** 139'-147'=.070/147'-153'=.020/153'-160'=.070

Pumping test 1,001 **GPM drawdown to** 65.07 **feet after** 24 **hours pumping.**

Driller	**Jim Parsley** **License #2058**

BASTIN LOGAN WATER SERVICES INC.

1010 HURRICANE ROAD
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Well Formation Log

Town of Danville - Well #3R

☐	**TEST**	**DATE**	5-20-13	***State***	Indiana	***Project***	3621-F
		Well No	3R	***City***	Danville	***Section***	3
☐	**PERMANENT**	**UTM 16S**	541466	***County***	Hendricks	***Township***	15N
		UTM	4401676	***Civil Twsp***		***Range***	1W

OWNER	Town of Danville
LAND DESCRIPTION	1,200' north of park entrance - 320' east of Helton Drive
Street or Road	

FORMATION	**From Natural Ground Level**			
	Depth top of stratum (ft)	**Depth bottom of stratum (ft)**	**Thickness of stratum**	**Static Water level**
Fine medium coarse sand & gravel	125	128	3	
Fine medium coarse sand-fine, medium gravel	128	129	1	
Soft clay w/ fine medium gravel	129	138	9	
Fine medium coarse sand & gravel	138	148	10	
Fine sand	148	152	4	
Fine medium coarse sand & gravel	152	155	3	
Fine medium coarse sand-fine medium gravel	155	157	2	
Fine medium coarse sand & gravel-1-3" rocks & bould	157	160	3	
Soft clay	160	163		

Hole 20" dia Drilled by Cable Tool

Rotary Hole Grouted with

Casing 20" OD from 2'-0" above grade to 139' below grade.

Screen 20" Tele. set from 139' to 160' feet Weight 78.67

Make Johnson Type SSWW Hi-Flow Slot 139'-147'=.070/147'-153'=.020/153'-160'=.070

Pumping test 1,001 GPM drawdown to 65.07 feet after 24 hours pumping.

	Driller	**Jim Parsley** **License #2058**

TUBULAR WELL PRINT

TOWER HEIGHT 4' ft.

Pipe extend 4' feet above ground level

JOB NO. 1572-F.

CUSTOMER Danville Water.

TUBULAR WELL NO. #4.

Location from street or road:

Park.

COUNTY Hendricks.

TOWNSHIP Center.

SECTION 3 T15N R1W.

STATE Indiana.

-----------Pipe size 20" & 18"

Wall Thickness 3/8"

DEPTH 109'

-------Seal packer x 14'4"

--------Blank Tube size 6" S.S.
Length 11'

DEPTH 134'

------Steel Drive Shoe 20" dia.

----Well Screen 6" Gravel pack
Type Johnson
Slot Size .080"
Gravel Pack #20

------18" Bore

DEPTH 154'

Static Level 23'.
Pumped 726 GPM
at 5" vac pumping level
after 24 hours
Drawdown.
Specific Capacity Special.
DRILLER Delford Dunn.
DATE COMPLETED 10/95.

Transmitting Capacity *700 GPM @ .1 per/sec

TUBULAR WELL PRINT

TOWER HEIGHT 4'-0 ft.

Pipe extends 4'-0 feet above ground level

JOB NO. 1572

CUSTOMER DANVILLE WATER

TUBULAR WELL NO. 4

Location from street or road:
PARK

COUNTY HENDRICKS

TOWNSHIP CENTER

SECTION 3 T15N R1W

STATE IN.

Top Casing 851'

0'-0" Grade 846'

Pipe size 20" & 18"

Wall Thickness 3/8"

Pipe
Lengths

Depth 109'

~~lead seal expanded against pipe~~ SEAL PACKER x 14'-4"

Blank tube size 6" S.S.
Length 11'-0

Depth 134'

Steel Drive Shoe
20" DIA.

6" Well Screen GRAVEL PACK

Type JOHNSON

Slot size .080

GRAVEL PACK #20

18" Bore

Depth 154'

Static Level 23'-0

Pumped 726 GPM

at 5" VAC. pumping level

after 24. hours

Drawdown —

Specific Capacity — SPECIAL

DRILLER D. DUNN

DATE COMPLETED 10/95

TRANSMITTING CAPACITY.
* 700 GPM @ .1 PER/SEC.

PUMP INSTALLATION PRINT

WELL NO. #4

DATE October 17, 1995

CUSTOMER Town of Danville

CITY Danville, Indiana

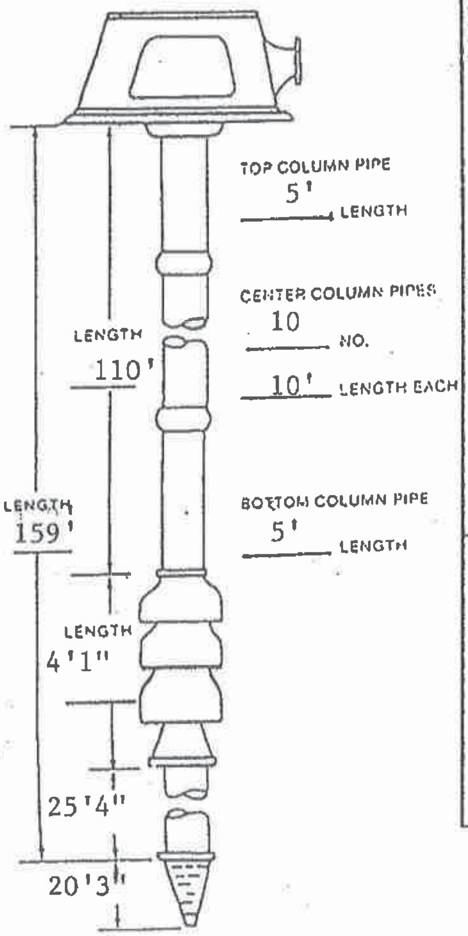
PROJECT NO. 1572-F PUMP BRAND Simmons S/N 1482-F PUMP PULLED/Hydrocrane

WELL/PUMP LOCATION Park

POWER LINE? No.

Electric Motor Brand Name US Type RUS Frame 326TP S/N R-231201
Design 800 GPM Pin size at Head 1 3/16 Motor Shaft Dia. 1 3/16
Capacity 186' TDH Keyway 1/4" Motor Shaft Length 33
H.P. 50 Volts 230 Amps RPM 1800 Line Voltage 230 Phase 3
Upper Bearing Motor Repaired New SRC
Lower Bearing C.D. of Motor 28 1/2" Clutch Dia. 1 3/16" NRR X

Angle Gear Drive Brand Name S/N Gear Ratio
Auxillary Engine Brand Name Model No. S/N



Discharge head Type SP
Discharge Line Size 8"
Location above grade
Column to Head Flgd.
Base Plate No
Pump Top Shaft 71' Length
Coupled above
Diameter 1 3/16"

Column Pipe Size 8"
Flanged Coupled C.I.
Special Paint no
Water Lube
Shaft Size 1 3/16" SS
Tubing Size
STL BRZ

Bowl Assembly Type 12LD Peerless
Shell Dia. 12 Stages 3
Shell Material C.I.
Imp. Shaft Dia.
Material S.S.
Length

* Base Ht. 4'

Suction Pipe size 6"
Special Paint
Length S.S.
Threads on Bottom? Yes
Strainer Special
Rubber Bumper none
Well Seal Special

WELL DATA FROM PUMP HEAD BASE

Inside Dia. 18 Depth Static Type Well
Airline Materials plastic Size 1/8" O.D. Attached?
Tower Height 4' System Operating Pressure
Pumping Test gpm @ ft. Pumping Level
with # discharge pressure after hour(s)
Water Discharge To: Open thru Orifice

Pump Repaired Last New
Well Cleaned Last New

Delford Dunn
Installer

BASTIN LOGAN WATER SERVICES INC.

1010 HURRICANE ROAD
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Well Formation Log

Town of Danville - Test Well # 19-1

x	**TEST**	DATE	7/10/2019	*State*	Indiana	*Project*	4584-F
		Well No	19-1	*City*	Danville	*Section*	3
	PERMANENT	UTM 16S	0541158	*County*	Hendricks	*Township*	15N
		UTM	4403112	*Civil Twsp*	Center	*Range*	1W

OWNER	Town of Danville
LAND DESCRIPTION	113' west of West Fork White Lick Creek
Street or Road	162' north of South Property Line, 594' West of E. Columbia and Sycamore

FORMATION	From Natural Ground Level			
	Depth top of stratum (ft)	Depth bottom of stratum (ft)	Thickness of stratum (ft)	Static Water level
Top soil	0	2	2	
Soft sandy brown clay	2	9	7	
Soft sandy gray clay with gravel	9	24	15	
Gray clay w/ gravel	24	33	9	
Soft gray clay w/ gravel	33	41	8	
fine medium coarse sand and gravel with boulders	41	46	5	
fine medium coarse sand and gravel with boulders	46	52	6	45.5'
Gray clay with gravel	52	76	24	
Sand and gravel with gray clay	76	82	6	
Gray clay with gravel	82	113	31	
Sand and gravel with gray clay	113	124	11	
Sandy gray clay with gravel	124	136	12	
Fine med coarse sand with some fine to coarse gravel	136	138	2	
Fine medium coarse sand and gravel	138	143	5	
Fine medium coarse sand and gravel	143	148	5	
Fine medium coarse sand and gravel	148	152	4	

Hole 6" dia Drilled by Cable Tool
Rotary Hole Grouted with
Casing 6 5/8" OD from 3' above grade to 143' below grade.
Screen 5" set from 140' to 150' feet Weight 18.97pf
Make Shop Type PVC Slot 0.30
Pumping test

Driller	**Rex Bussinger** **License #768WDPI**

BASTIN LOGAN WATER SERVICES INC.

1010 HURRICANE ROAD
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Well Formation Log

Town of Danville - Test Well # 19-1

x	**TEST**	**DATE**	7/10/2019	***State***	Indiana	***Project***	4584-F
		Well No	19-1	***City***	Danville	***Section***	3
	PERMANENT	**UTM 16S**	0541158	***County***	Hendricks	***Township***	15N
		UTM	4403112	***Civil Twsp***	Center	***Range***	1W

OWNER Town of Danville
LAND DESCRIPTION 113' west of West Fork White Lick Creek
Street or Road 162' north of South Property Line, 594' West of E. Columbia and Sycamore

FORMATION	From Natural Ground Level			
	Depth top of stratum (ft)	Depth bottom of stratum (ft)	Thickness of stratum	Static Water level
Fine medium coarse sand trace fine to medium gravel	152	154	2	
Fine sand with wood	154	156	2	
Fine medium sand trace fine to medium gravel	156	161	5	
Limestone	161	163	2	

Hole 6" dia Drilled by Cable Tool
Rotary Hole Grouted with
Casing 6 5/8" OD from 3' above grade to 143' below grade.
Screen 5" set from 140' to 150' feet Weight 18.97pf
Make Shop Type PUC Slot 0.30
Pumping test

Driller **Rex Bussinger**
License #768WDPI

BASTIN LOGAN WATER SERVICES INC.

1010 HURRICANE ROAD
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Well Formation Log

Town of Danville - Test Well #19-2

X	**TEST**	**DATE**	7-12-19	***State***	Indiana	***Project***	4584-F
		Well No	19-2	***City***	Danville	***Section***	3
	PERMANENT	**UTM 16S**	0541412	***County***	Hendricks	***Township***	15N
		UTM	4402077	***Civil Twsp***	Center	***Range***	1W

OWNER	City of Danville
LAND DESCRIPTION	210' east of E. Columbia St. - 141' south of Sycamore Lane
Street or Road	272' S.E. of Intersection of E. Columbia & Sycamore Lane

FORMATION	From Natural Ground Level			
	Depth top of stratum (ft)	Depth bottom of stratum (ft)	Thickness of stratum	Static Water level
Top soil	0	2	2	
Brown sandy clay	2	17	15	
Soft sandy gray clay	17	23	6	
Soft gray clay with gravel	23	41	18	
Gray clay with gravel	41	44	3	
Gray clay w/strips of gravel-boulders	44	49	5	
Gray clay with gravel	49	84	35	
Hard gray clay	84	89	5	
Soft gray clay with gravel	89	114	25	
Hard gray clay with gravel	114	127	13	
Gray clay with gravel	127	131	4	
Hard gray clay with gravel	131	140	9	
Sandy gray clay with gravel	140	154	14	
Fine medium coarse sand & gravel	154	157	3	
Sandy gray clay with gravel	157	162	5	
Boulders	162	164	2	

Hole 6" dia Drilled by Cable Tool
Rotary Hole Grouted with
Casing 6 5/8" OD from above grade to below grade.
Screen set from to feet Weight
Make Type Slot
Pumping test GPM drawdown to ______ feet after ______ hours pumping.

Driller **Rex Bussinger**
License # 768 WD PI

1010 HURRICANE ROAD
P.O. BOX 55
FRANKLIN, INDIANA 46131
(317) 738-4577
FAX (317) 738-9295

Well Formation Log

Town of Danville - Test Well #19-2

X	TEST	**DATE**	7-12-19	***State***	Indiana	***Project***	4584-F
		Well No	19-2	***City***	Danville	***Section***	3
	PERMANENT	**UTM 16S**	0541412	***County***	Hendricks	***Township***	15N
		UTM	4402077	***Civil Twsp***	Center	***Range***	1W

OWNER	City of Danville
LAND DESCRIPTION	210' east of E. Columbia St. - 141' south of Sycamore Lane
Street or Road	272' S.E. of Intersection of E. Columbia & Sycamore Lane

FORMATION	From Natural Ground Level			
	Depth top of stratum (ft)	Depth bottom of stratum (ft)	Thickness of stratum	Static Water level
Fine medium coarse sand & gravel	164	165	1	
Sandy gray clay	165	168	3	
Limestone	168	170	2	

Hole 6" dia Drilled by Cable Tool

Rotary Hole Grouted with

Casing 6 5/8" OD from ______ above grade to ______ below grade.

Screen ______ set from ______ to ______ feet Weight ______

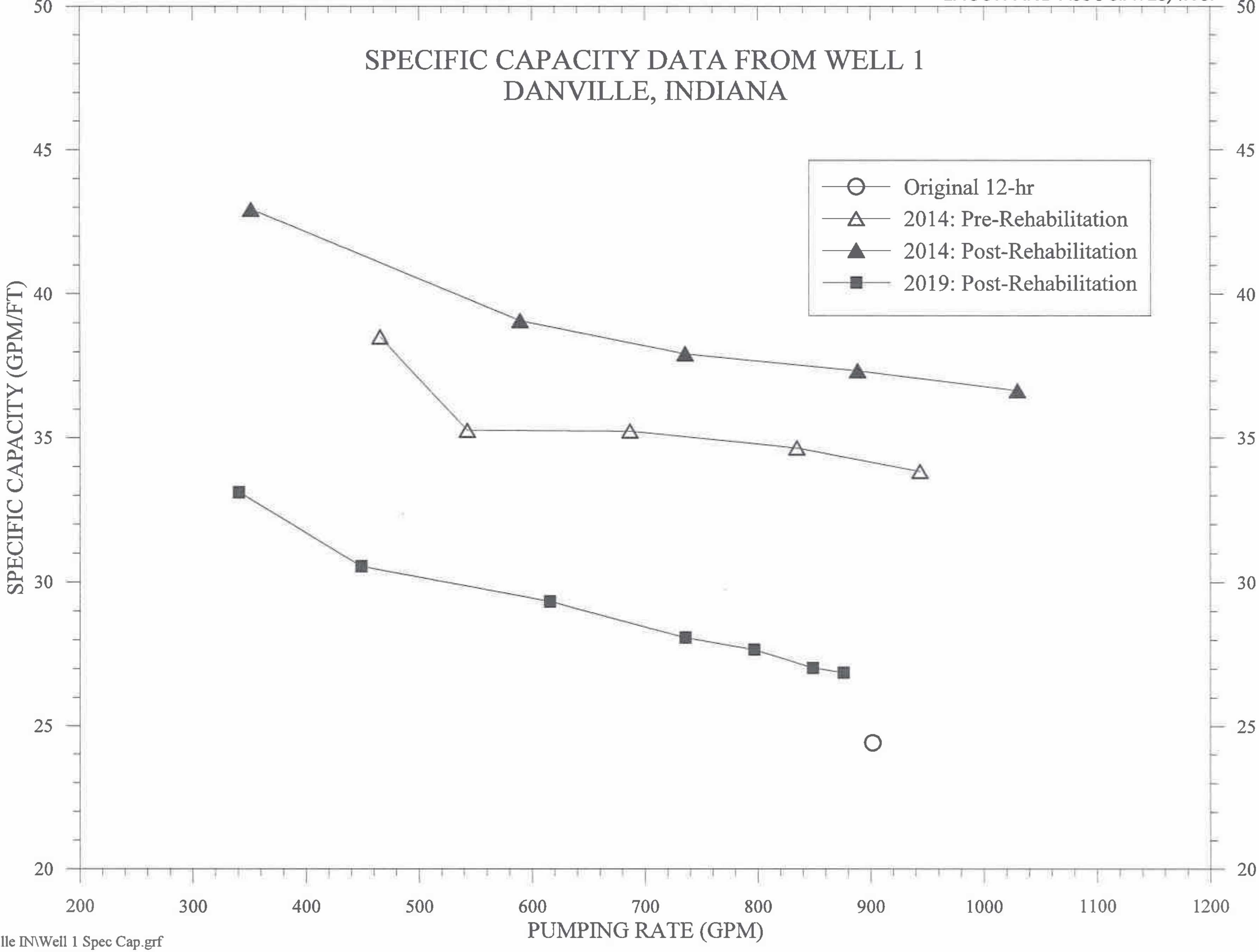
Make ______ Type ______ Slot ______

Pumping test ______ GPM drawdown to______feet after______hours pumping.

Driller	**Rex Bussinger** **License # 768 WD PI**

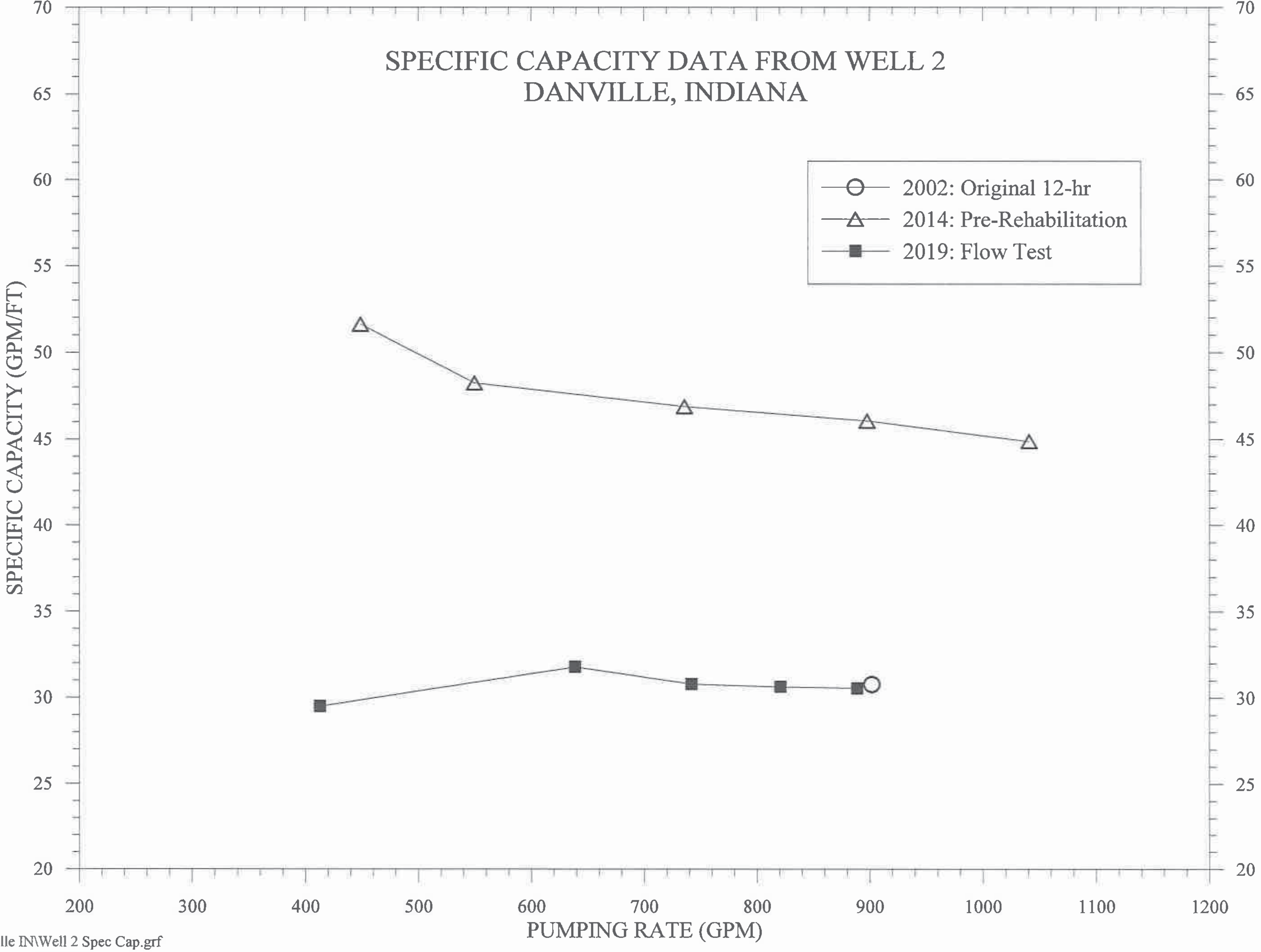
APPENDIX B.

SPECIFIC CAPACITY GRAPHS



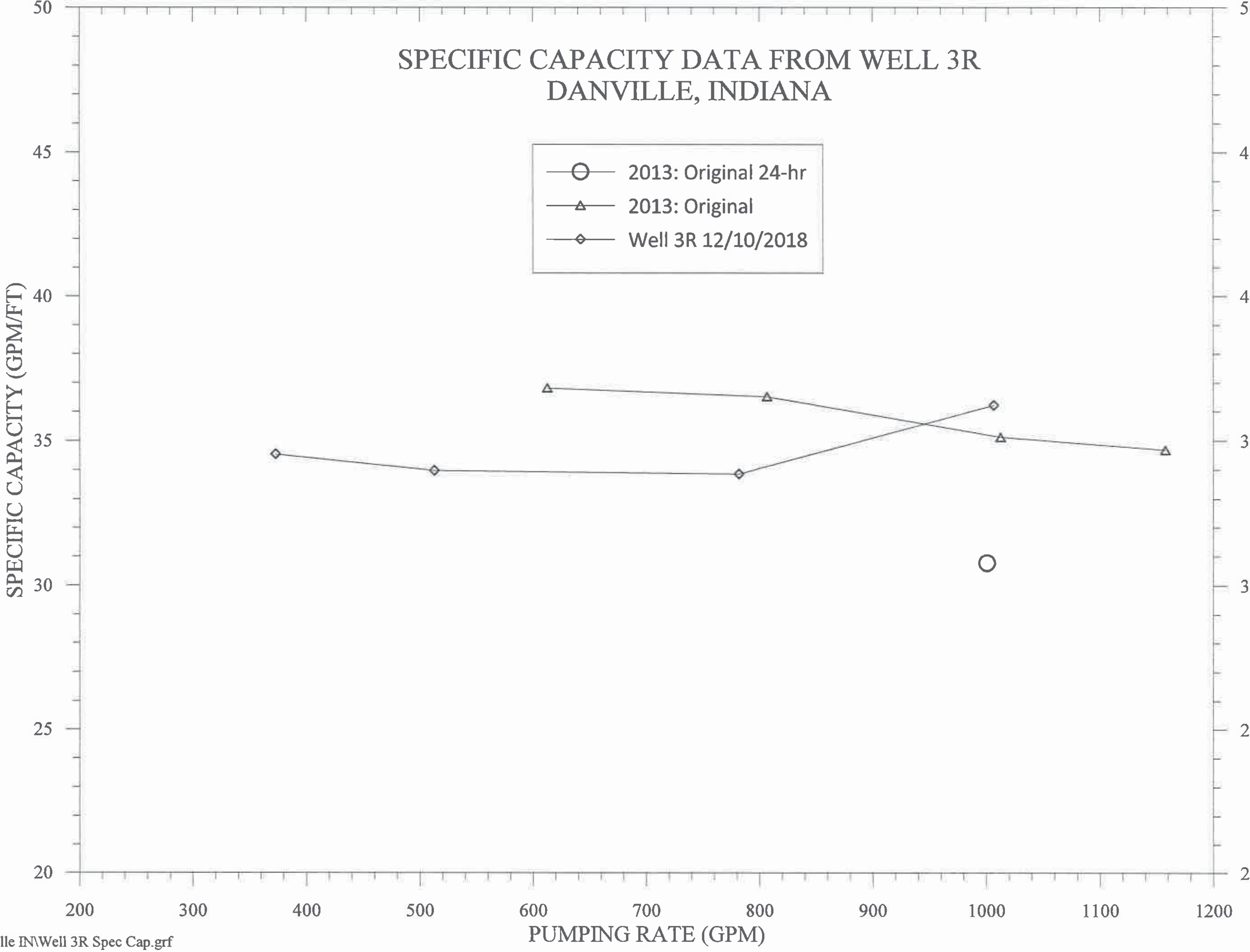
Danville IN\Well 1 Spec Cap.grf
11/5/2019

EAGON AND ASSOCIATES, INC.



Danville IN\Well 2 Spec Cap.grf
11/5/2019

EAGON AND ASSOCIATES, INC.



Danville IN\Well 3R Spec Cap.grf
11/5/2019

Element Materials Technology - Fort Wayne
328 Ley Rd.
Fort Wayne, IN 46825
TEL: (260) 424-1622 FAX: (260) 424-9124
Website: www.element.com

September 23, 2019

Joe Paszek
Bastin-Logan
P.O. Box 55
Franklin, IN 46131
TEL: (317) 738-4577
FAX: (317) 738-9295

RE: Danvillle TW 19-1

Order No.: 19083666

Dear Joe Paszek:

Element Materials Technology - Fort Wayne received 2 sample(s) on 8/29/2019 for the analyses presented in the following report.

In accordance with your instructions, Element Materials Technology Indiana conducted the analysis shown on the following pages on samples submitted by your company. The results relate only to the items tested. Unless otherwise noted, all analysis was conducted using approved methodologies from EPA, SM, or other client-specified methods. All relevant sampling information is on the attached chain-of-custody form. The initials SUB as the analyst designate any testing sub-contracted by Element Materials Technology Indiana.

This report shall not be reproduced except in full, without the written approval of the laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Jay Van Markwyk

Jay Van Markwyk
Manager, Analytical Services
328 Ley Rd.
Fort Wayne, IN 46825

Original

CLIENT: Bastin-Logan
Project: Danvillle TW 19-1
Lab Order: 19083666

Lab ID: 19083666-001
Client Sample ID: Danville TW
Collection Date: 8/29/2019 12:12:00 PM
Matrix: DRINKING WATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ORGANIC CARBON, TOTAL IN WATER				**SM5310C**		Analyst: **ADL**
Organic Carbon, Total	10.80	2.00		mg/L	20	9/13/2019 2:00:00 PM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
PQL	Practical Quantitation Limit	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

CLIENT: Bastin-Logan
Project: Danvillle TW 19-1

Lab Order: 19083666

Lab ID: 19083666-002
Client Sample ID: Danville TW

Collection Date: 8/29/2019 12:05:00 PM
Matrix: DRINKING WATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
INORGANIC CONTAMINANTS WITH SODIUM FLUORIDE				**E300.0**		Analyst: **AJE**
Fluoride	1.8	0.1		mg/L	1	8/30/2019 4:49:00 PM
INORGANIC CONTAMINANTS WITH SODIUM CYANIDE IN DW, TOTAL				**E335.4**		Analyst: **AJE**
Cyanide	< 0.020	0.020		mg/L	1	9/4/2019 3:49:36 PM
HARDNESS **CALCIUM & MAGNESIUM HARDNESS**				**E200.7**	**E200.7**	Analyst: **FJR**
Hardness, Calcium/Magnesium (As CaCO3)	212	1		mg/L	1	9/12/2019 1:17:23 PM
INORGANIC CONTAMINANTS WITH SODIUM MERCURY IN DRINKING WATER				**E245.1**		Analyst: **FJR**
Mercury	< 0.00010	0.00010		mg/L	1	9/5/2019 12:47:11 PM
INORGANIC CONTAMINANTS WITH SODIUM METALS IN DW BY ICP				**E200.7**	**E200.7**	Analyst: **FJR**
Iron	1.89	0.0200		mg/L	1	9/12/2019 1:17:23 PM
Manganese	0.0161	0.0100		mg/L	1	9/12/2019 1:17:23 PM
Sodium	39.8	0.200		mg/L	1	9/12/2019 1:17:23 PM
INORGANIC CONTAMINANTS WITH SODIUM METALS IN WATER BY ICP-MS, TOTALS				**E200.8**		Analyst: **FJR**
Antimony	< 0.0005	0.0005		mg/L	1	9/4/2019 10:33:05 AM
Arsenic	0.0081	0.0005		mg/L	1	9/4/2019 10:33:05 AM
Barium	0.811	0.0040		mg/L	1	9/4/2019 10:33:05 AM
Beryllium	< 0.0005	0.0005		mg/L	1	9/4/2019 10:33:05 AM
Cadmium	< 0.0005	0.0005		mg/L	1	9/4/2019 10:33:05 AM
Chromium	< 0.0010	0.0010		mg/L	1	9/4/2019 10:33:05 AM
Nickel	0.0011	0.0010		mg/L	1	9/4/2019 10:33:05 AM
Selenium	< 0.0010	0.0010		mg/L	1	9/4/2019 10:33:05 AM
Thallium	< 0.0005	0.0005		mg/L	1	9/4/2019 10:33:05 AM

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
PQL	Practical Quantitation Limit	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Qualifiers:

H	Holding times for preparation or analysis exceeded	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
PQL	Practical Quantitation Limit	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

element™

Chain of Custody

SAMPLES MEET ACCEPTANCE POLICY [✓ Y] N

Laboratory Number: 19083666

Client Information:

Company Name: Bastin & Logan

Contact Name: Joe Paszek

Address:

City, State Zip:

Phone Number: Ext:

Fax Number:

E-mail Address:

Billing Information:

Ext:

PO Number:

Quote Number:

Required QC Level

Bill Monthly ☐ Yes ☐ No

Project Name/Number: Danville Tw. 19-1

Sampler's Signature Re B

Shipping Method: UPS / FedEx / NOW / DHL / Element / [✓ Hand] / Mail

Page of

Matrix Code

DW = Drinking Water
WW = Waste Water
GW = Ground Water
AQ = Aqueous
OT = Other
SL = Sludge SOL = Solid
O = Oil SO = Soil
F = Food SW = Swab
NG = Natural Gas
NGL = Natural Gas Liquid
PW = Produced Water
CF = Completion Fluid

Which Regulations Apply:

☐ RCRA
☐ POTW
☐ NPDES
☐ USDA/FDA
☐ RECAP/RISC
☒ Drinking Water
☐ Distribution
☐ Special
☐ State
☐ Other

Turn Time

☒ Standard
RUSH
☐ 1 Day
☐ 2 Day
☐ Other

(Rush turn times will incur a surcharge and must be pre-approved by lab.)

Sample ID/Description	Collection Information Date	Time	Grab / Composite	Matrix	Container Quantity	Type P=Plastic, G=Glass, V=Vial	Pres. HCl, HNO$_3$, H$_2$SO$_4$, NaOH, Na$_2$S$_2$O$_3$	IOC Mets w/sodium	mang/Fe Hardness	IOC Flouride	IOC CN	TOC						Comments
Metals w/sodium	8/29/19	12:05	Grab	DW	1	P	HNO3	✓										
Mang Fe Hardness	↓	12:06	↓	↓	1	P	HNO3		✓									
Flouride	↓	12:08	↓	↓	1	P	Iced			✓								
Cyanide	↓	12:10	↓	↓	1	P	NaOH				✓							
TOC	↓	12:12	↓	↓	2	G	H2SO4					✓						

	Relinquished by	Date/Time	Received by	Date/Time
1	Re B	8/29/19 1518		8/30/19 1518
2				
3				

Field Notes:

Received at lab on ice? ☒ Yes ☐ No Temp: 4

All samples submitted to Element Materials Technology for analysis are accepted on a custodial basis only. Ownership of the material remains with the client submitting the samples. Element Materials Technology reserves the right to return unused sample portions.

8800 North US 31
Columbus, IN
47201 USA
P 812-375-0531
F 812-375-0731

328 Ley Road, Suite 100
Fort Wayne, IN
46825 USA
P 260-471-7000
F 260-471-7777

909 Executive Dr
Warsaw, IN
46580 USA
P 574-267-3305
F 574-269-6569

3371 Cleveland Road, Suite 100A
South Bend, IN
46628 USA
P 574-277-0707
F 574-273-5699

2417 W. Pinhook Rd
Lafayette, LA
70508 USA
P 337-235-0483
F 337-233-6540

CHAIN OF CUSTODY RECORD

Omega COCID 123355	PAGE: 1	OF: 1

ADDRESS
Element Materials Technology - Columbus
8800 North US 31
Columbus, IN 47201
TEL: (812) 375-0531
FAX: (812) 375-0731
Website: www.element.com

M-83

Lab ID	**FTW01**	Lab Name	**Element Materials Technology**
ADDRESS:	**328 Ley Rd.**		
CITY, STATE, ZIP:	**Fort Wayne, IN 46825**		
PHONE: **(260) 424-1622**	FAX: **(260) 424-9124**	EMAIL:	
ACCOUNT #:			

SPECIAL INSTRUCTIONS / COMMENTS:
Bastin Logan

W / UPS / Fed Ex

ITEM #	SAMPLE ID	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	DATE COLLECTED	NUMBER OF CONTAINERS	COMMENTS: Methanol Preserved Weights HOT Sample Notation, Additional Sample Description
1	19083666-002A CMHARD, Hg_DW, MET_DW_ICP, MET_DW_ICPMS	19083666-002A	250HDPE-HNO3	Drinking Water	8/29/2019 12:05:00 PM	2	
2	19083666-002B Fluor_300	19083666-002B	250HDPE	Drinking Water	8/29/2019 12:05:00 PM	1	
3	19083666-002C CYAN_T_DW	19083666-002C	250HDPENAOH	Drinking Water	8/29/2019 12:05:00 PM	1	

Shipping Method: (circle)
[✓ NOW] / UPS / Fed Ex

Relinquished By: Ashlyn Pool	Date: **8/29/2019**	Time: **3:56 PM**	Received By:	Date: 8-30-19	Time: 10:15
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☐ **RUSH** Next BD ☐ 2nd BD ☐ 3rd BD ☐

Note: RUSH requests will incur surcharges!

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY
Temp of samples 5 °C Attempt to Cool? Y
Comments:

CHAIN OF CUSTODY RECORD

Omega COCID 123424 PAGE: 1 OF: 1

ADDRESS

Element Materials Technology - Columbus
8800 North US 31
Columbus, IN 47201
TEL: (812) 375-0531
FAX: (812) 375-0731
Website: www.element.com

Lab ID **WAR01** Lab Name **Element Materials Technology**

ADDRESS: **909 Executive Drive**

CITY, STATE, ZIP: **Warsaw, IN 46580**

PHONE: **(574) 267-3305** FAX: **(574) 269-6569** EMAIL:

ACCOUNT #:

SPECIAL INSTRUCTIONS / COMMENTS: Bastin Logan

ITEM #	SAMPLE ID	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	DATE COLLECTED	NUMBER OF CONTAINERS	COMMENTS: Methanol Preserved Weights HOT Sample Notation, Additional Sample Description.
1	19083666-001A TOC	19083666-001A	250HDPE-HNO3	Drinking Water	8/29/2019 12:05:00 PM	2	

Shipping Method: (circle)

NOW / UPS / [✓ Fed Ex]

Relinquished By:	Date: 9/4/2019	Time: 1:54 PM	Received By:	Date: 9/5/19	Time: 930
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☐ **RUSH** Next BD ☐ 2nd BD ☐ 3rd BD ☐

Note: RUSH requests will incur surcharges!

REPORT TRANSMITTAL DESIRED:

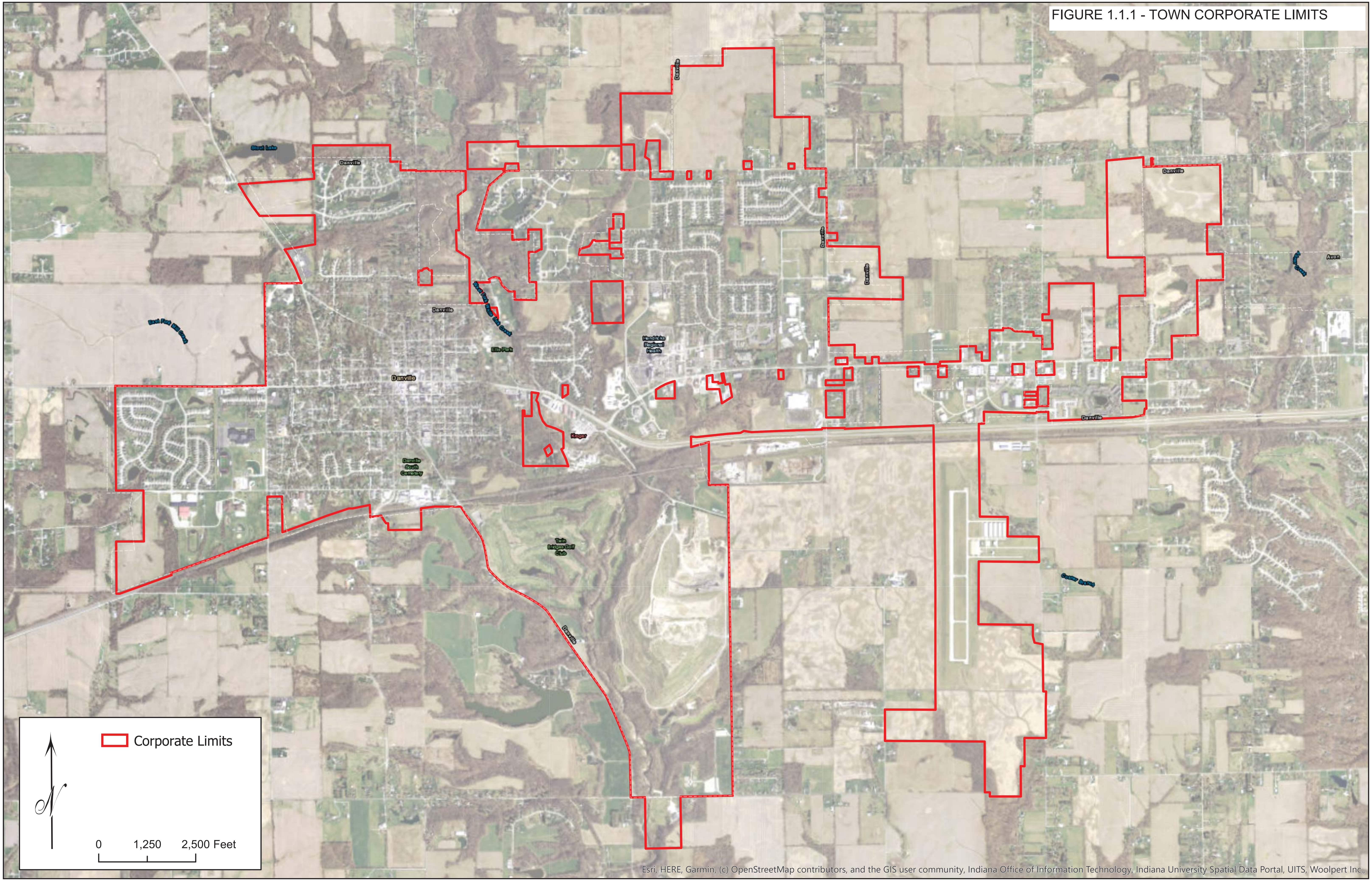
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY

Temp of samples 3.6 °C Attempt to Cool ? yes

Comments: Samples good

FIGURE 1.1.1 - TOWN CORPORATE LIMITS



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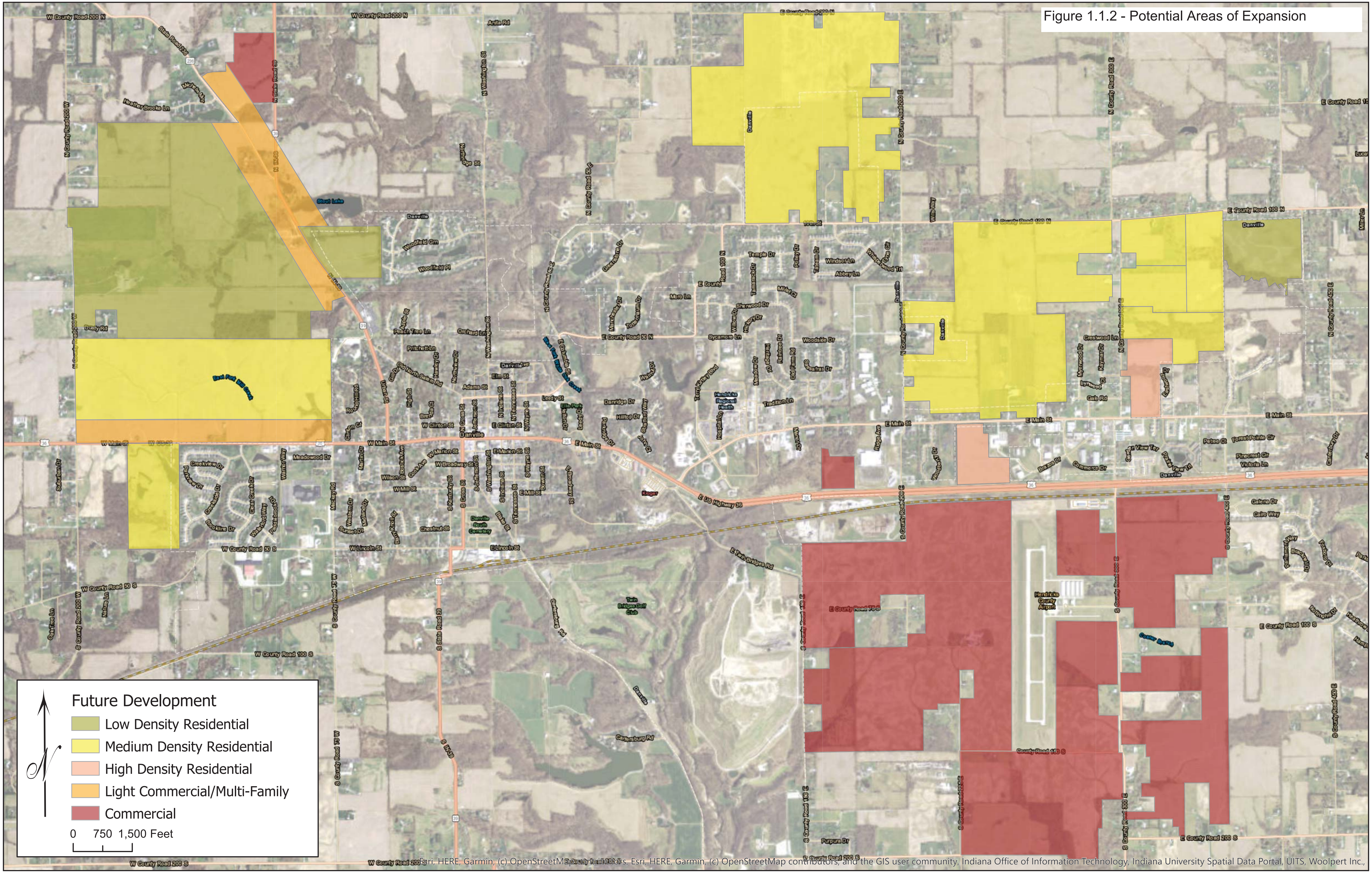

Figure 1.1.2 - Potential Areas of Expansion

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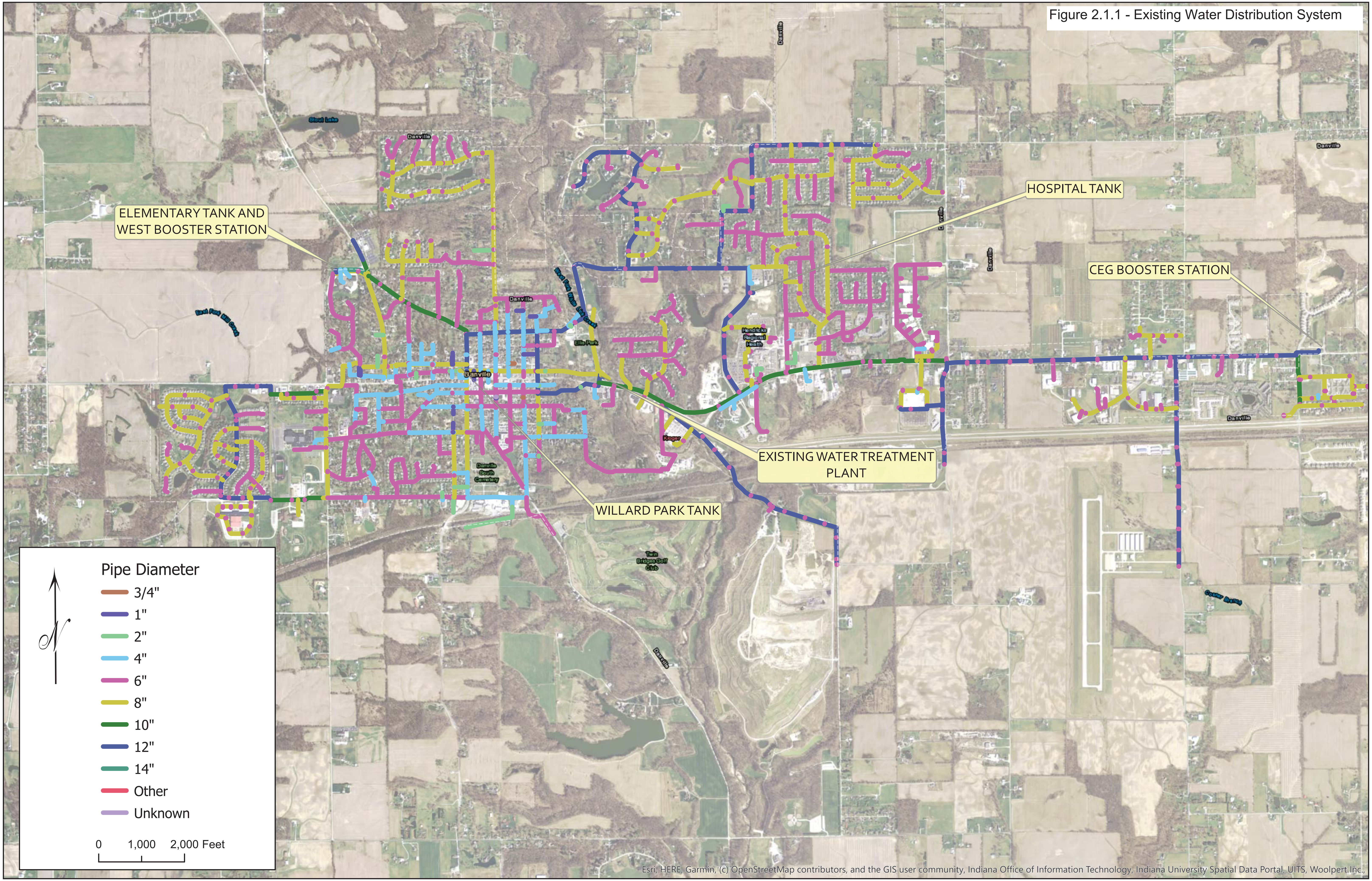
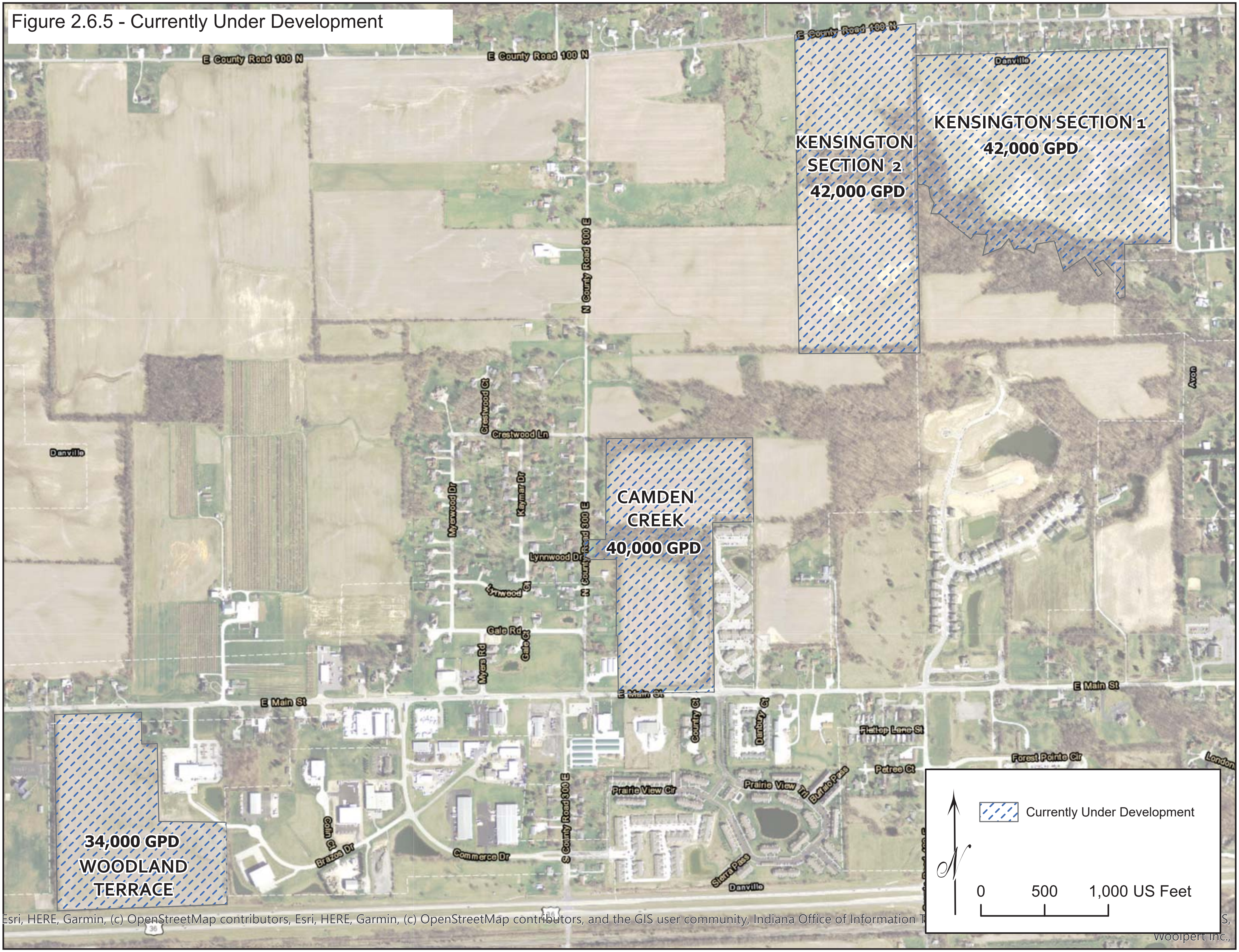
Figure 2.1.1 - Existing Water Distribution System



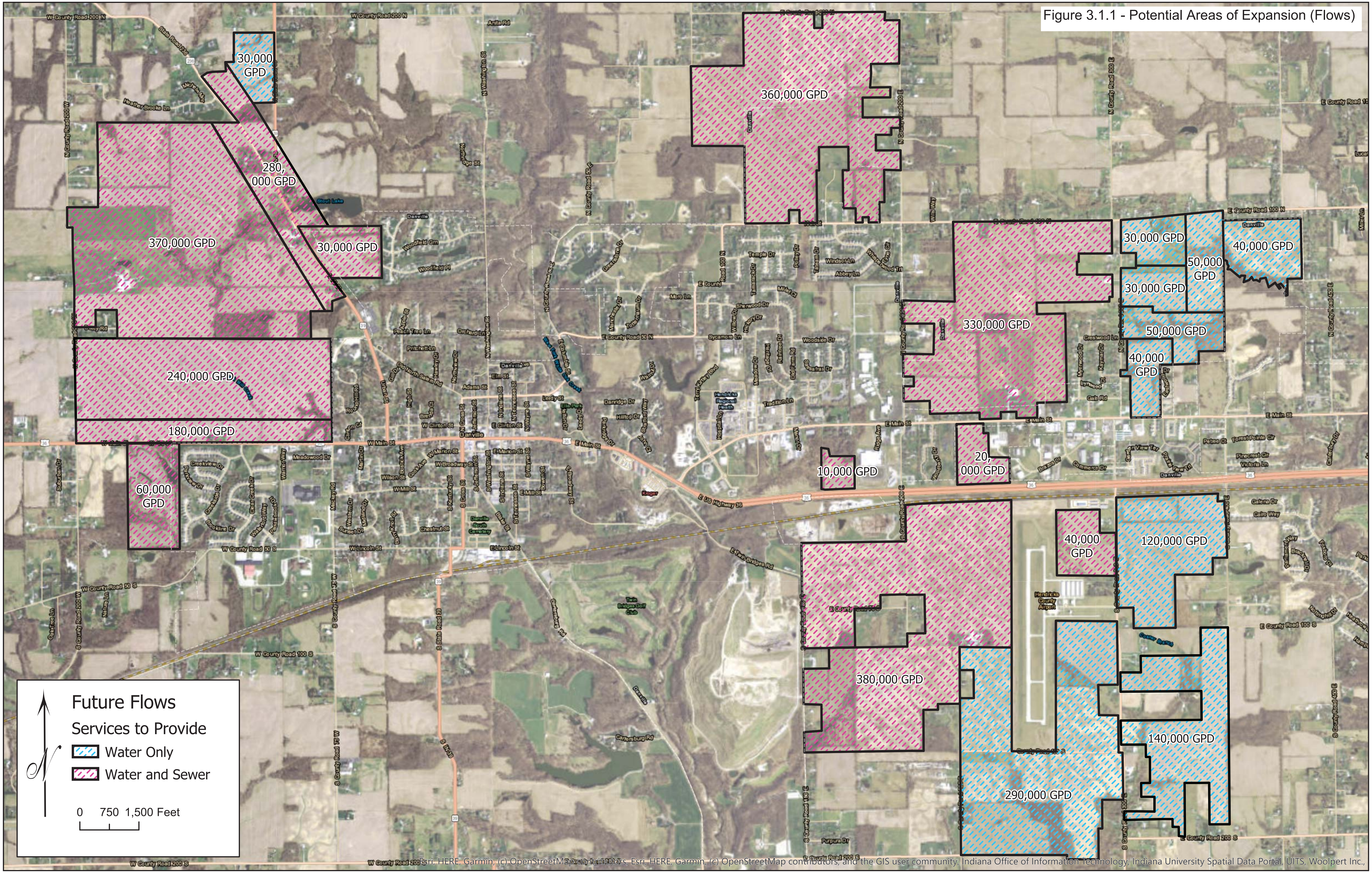
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.,

Figure 2.6.5 - Currently Under Development



Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Indiana Office of Information T S, Woolpert Inc.,

Figure 3.1.1 - Potential Areas of Expansion (Flows)



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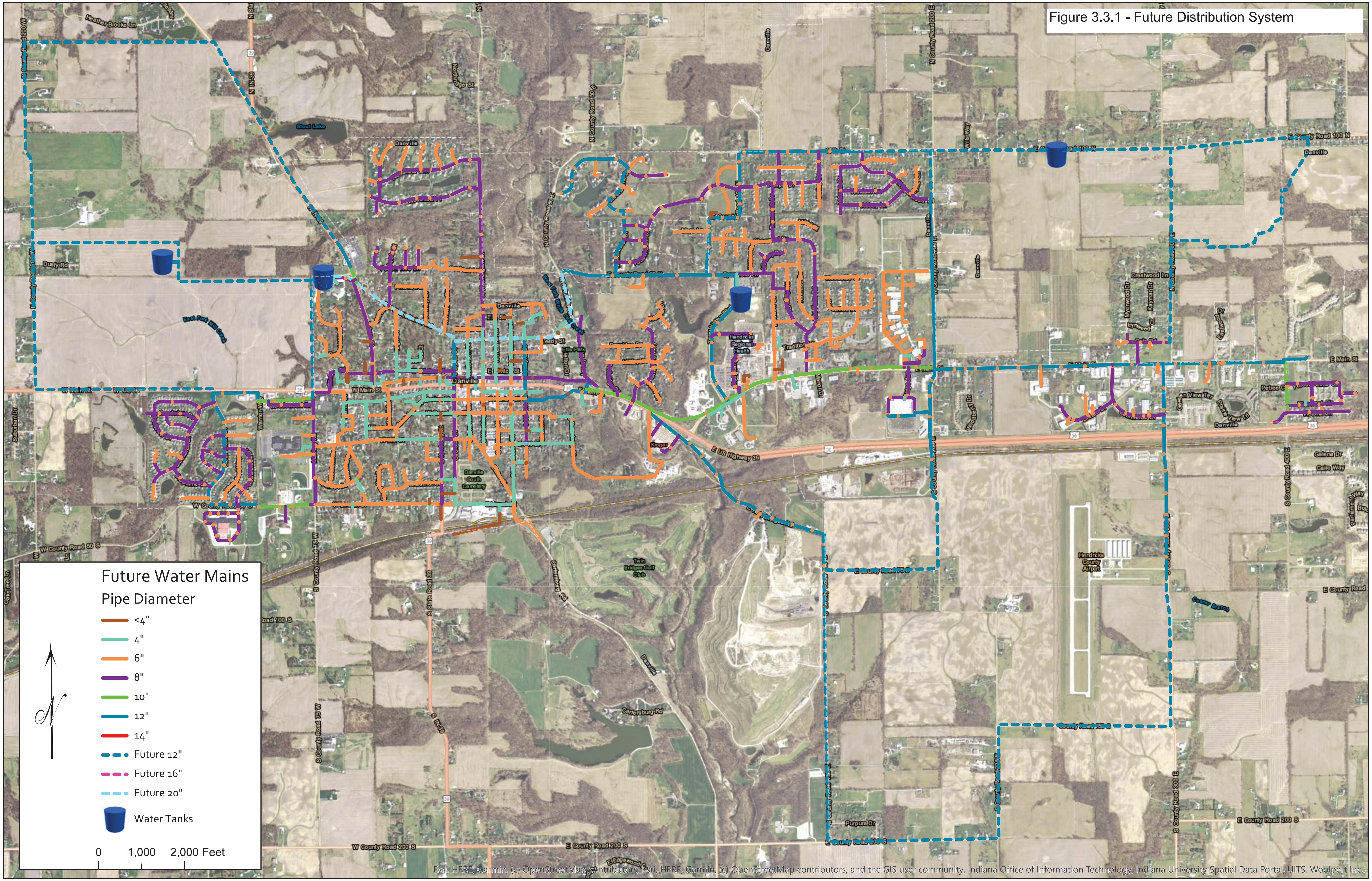

Figure 3.3.1 - Future Distribution System

Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.

Figure 5.2.1 - Existing Plant, Proposed Plant, and Well Field

Figure 5.2.2 - Proposed Treatment Plant and Additional Wells

Figure 5.2.3 - Future Upgrades to Existing Well Field

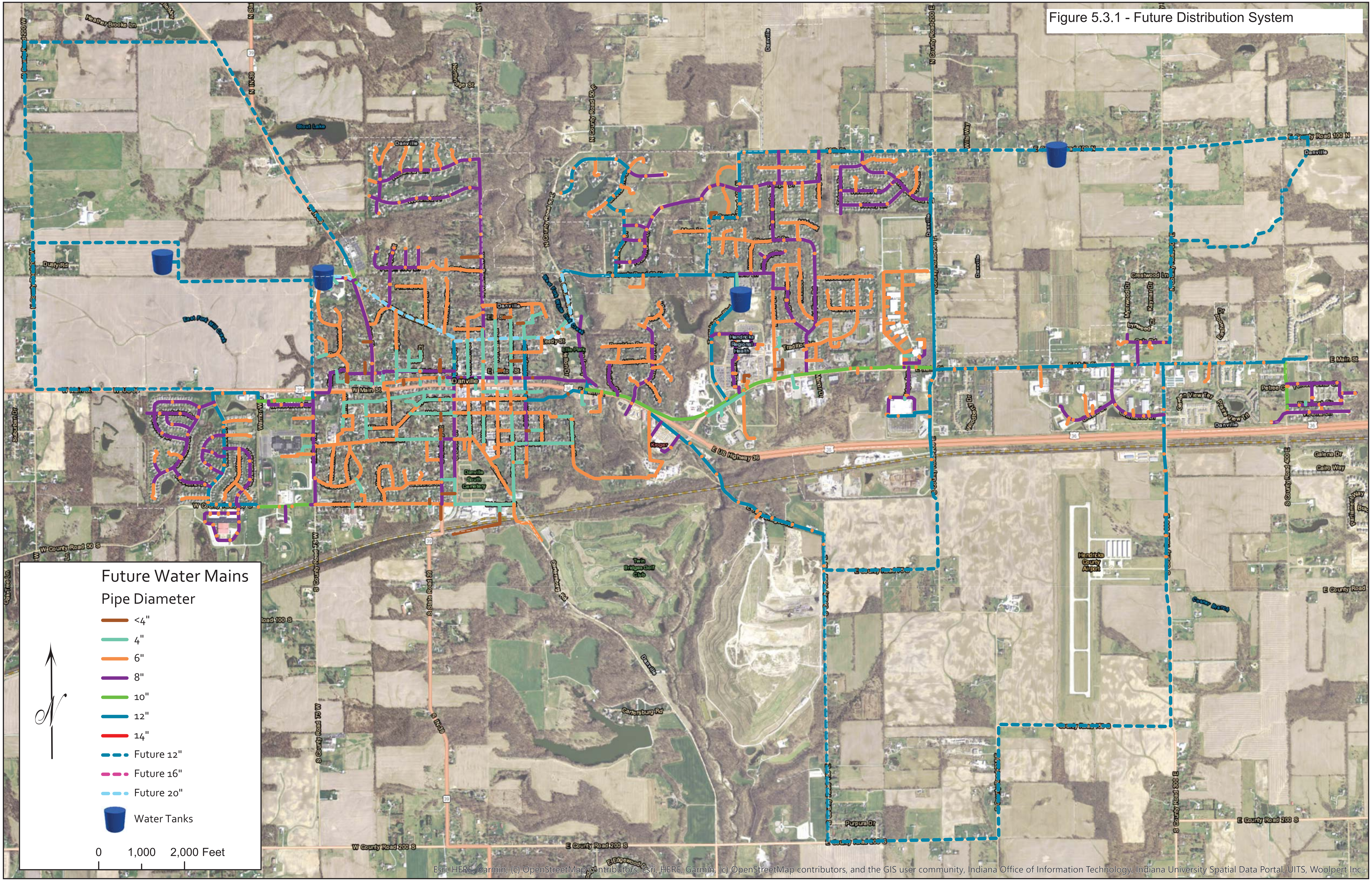

Figure 5.3.1 - Future Distribution System

Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Indiana Office of Information Technology, Indiana University Spatial Data Portal, UITS, Woolpert Inc.

Figure 5.3.2 - East Watermain Extensions

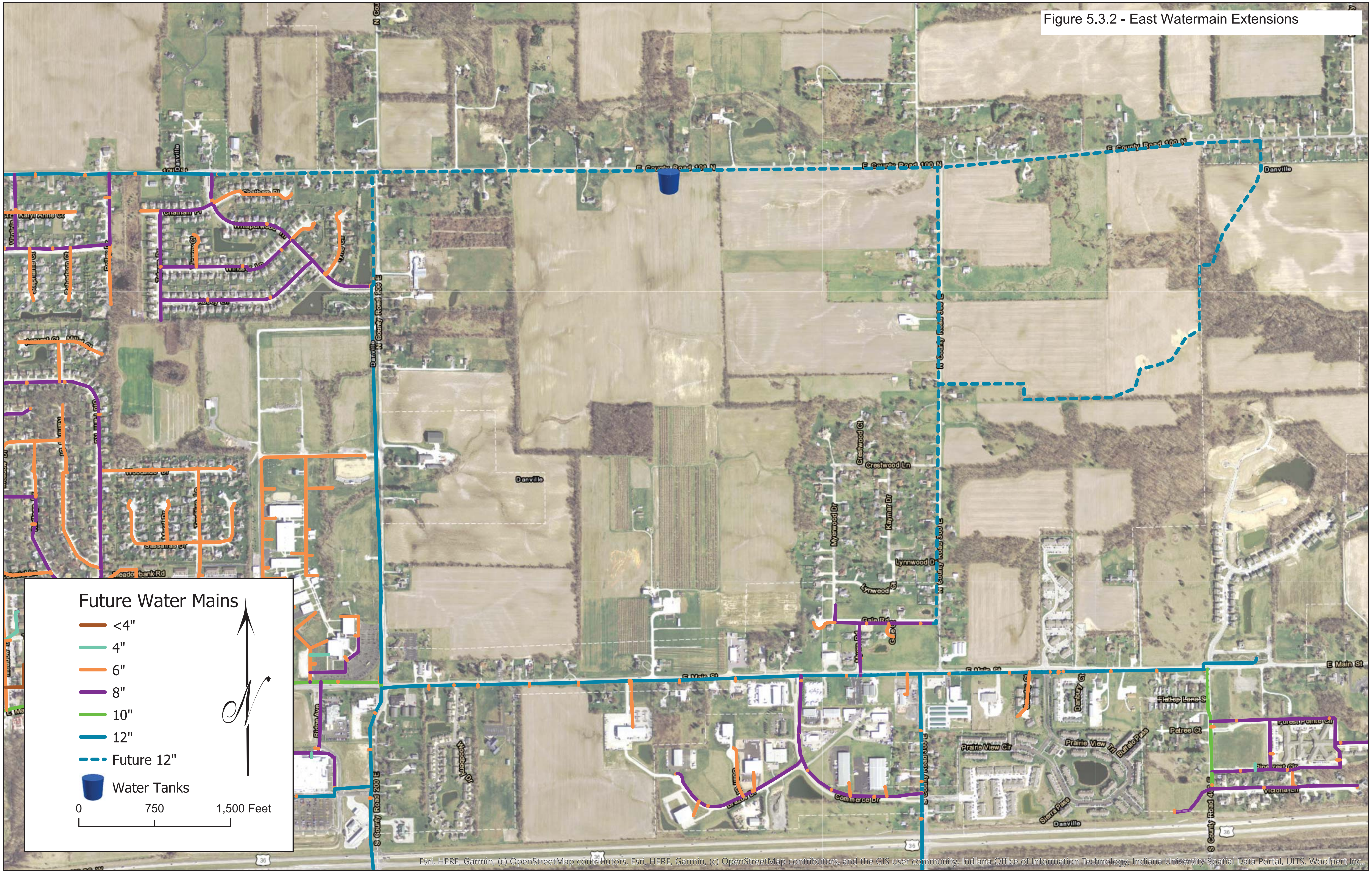

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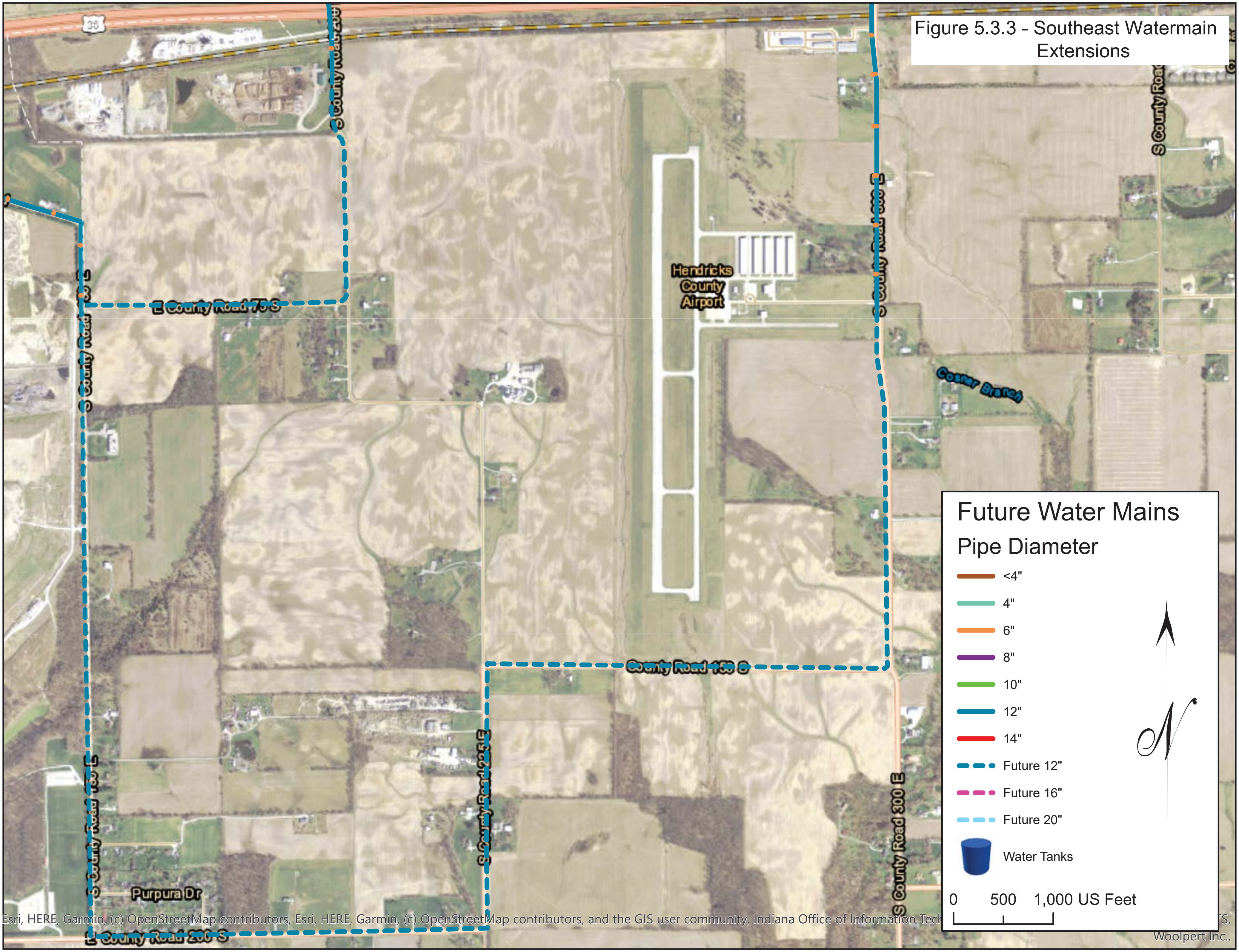
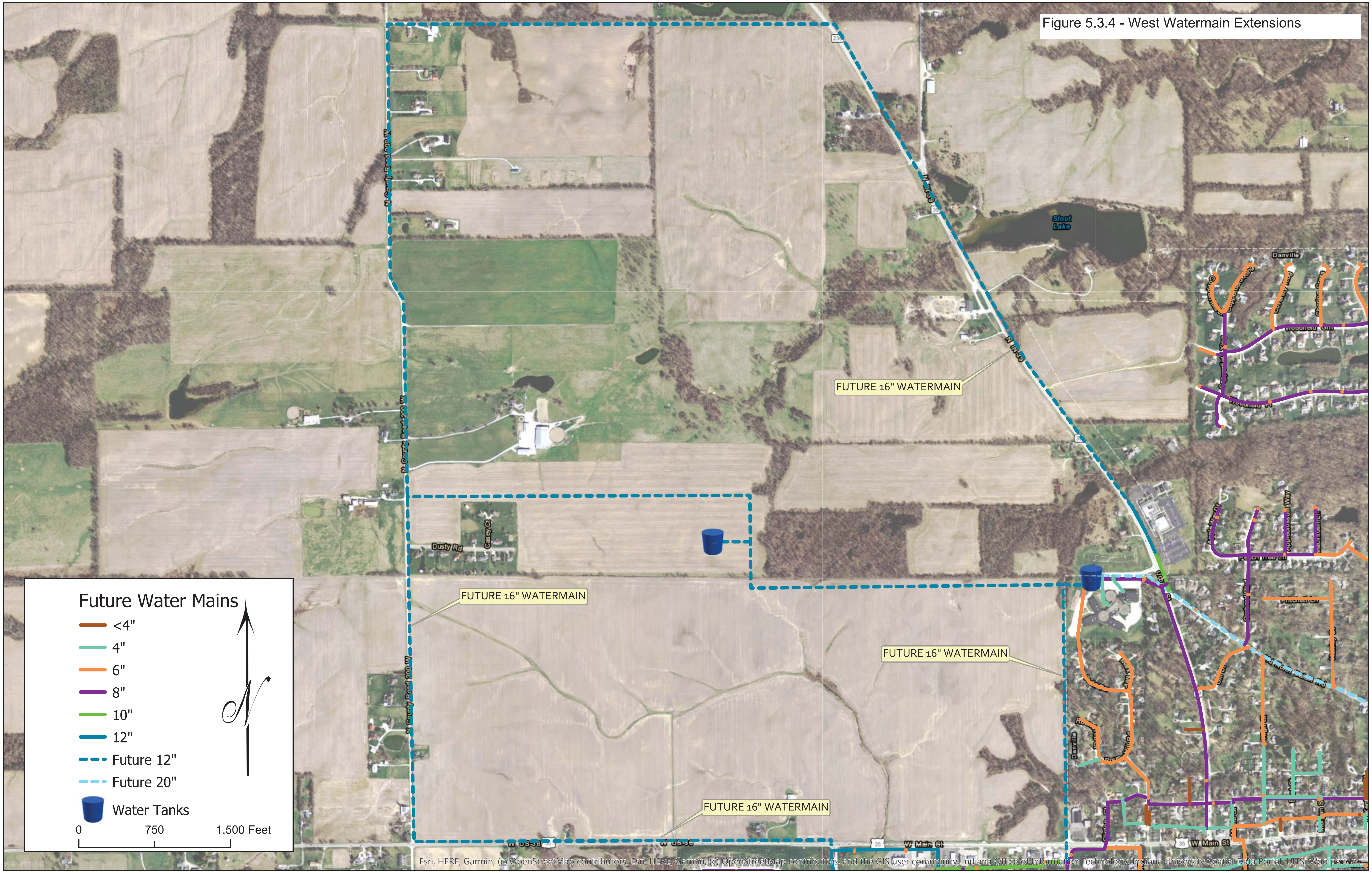
Figure 5.3.3 - Southeast Watermain Extensions



Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Indiana Office of Information Tech TS, Woolpert Inc.,

Figure 5.3.4 - West Watermain Extensions



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